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Believing, Thinking, and Doing:
Physical Therapist Students' Clinical Reasoning and Characterizations of Practice

DISSERTATION

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

In Education

By

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DEDICATION

To

All my future students

That this work may enhance your learning experiences
And support you in becoming better physical therapists

And

All of my teachers
Who taught me that thinking about teaching matters

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ABSTRACT OF THE DISSERTATION

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By

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Doctor of Philosophy in Education

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Professor Judith H Sandholtz, Chair

This dissertation study examined how physical therapist (PT) students from two entry-level physical therapist educational programs characterized practice and engaged in clinical reasoning. The theoretical frame for this study identified four capacities, a well-organized knowledge base, the ability to effectively interact with patients, the ability to manage decision making in a context of uncertainty, and a patient-centered, biopsychosocial orientation to practice, required for effective clinical reasoning. This study addressed four primary research questions: How do PT students characterize physical therapy practice? During an encounter with a patient, what clinical decisions do PT students make, and what clinical reasoning strategies underlie their decisions? What is the relationship between PT students' characterizations of practice and their clinical decisions? Do PT students' clinical decisions and reasoning strategies vary across educational programs? This qualitative study drew on PT students' responses to interview questions concerning their conceptualizations of practice and PT students' performance on and explanations of a standardized patient case. Although all students were at the same stage of their education, some characterized physical therapy with a focus on patient education and emotional support consistent with expert practice, while others described a focus

on technical and biomechanical issues more characteristic of novice practice. Students' abilities to organize their knowledge impacted their clinical decision-making. Further, students' actions during the clinical encounter ranged from typical novice practice focused on diagnosing the pathology to more advanced practice focused on assessing and addressing the patient's emotional and behavioral needs. The problems students framed and decisions they made during the patient encounter paralleled their characterizations of practice. Each of the four capacities played a crucial role in their clinical reasoning. The differences in the perspectives and clinical reasoning of the students from the two programs suggest that program level factors impacted their development of clinical reasoning. The findings from this study support a model of clinical reasoning that demonstrates the influence of students' perspectives on practice on their use of content specific reasoning and interactional skills for clinical reasoning. Further, this study has highlighted the importance of reflection both in- and on-action for students' clinical decision-making and professional development.

Chapter 1

Introduction

Many physical therapist (PT) students and novice clinicians demonstrate shortcomings in their clinical practice that are likely due to poor clinical reasoning abilities. PT students make errors during their clinical affiliations related to insufficient knowledge and ineffective patient interaction skills (Hayes, Huber, Rogers, & Sanders, 1999). Novice clinicians have difficulty responding to patients' unique needs. Further, novices struggle to integrate patient interactions with their own technical practices (Jensen, Shepard, Gwyer, & Hack, 1992). Limitations in clinical reasoning abilities likely underlie all of these difficulties.

Clinical reasoning is a complex problem-framing, problem-solving, and decision-making process necessary for effective healthcare practice. This highly context-dependent process requires interaction with the patient, caregivers, and other healthcare team members and is influenced by models of practice (Higgs & Jones, 2008). The Clinical Reasoning Research and Curriculum Consortia of the American Council of Academic Physical Therapy (ACAPT) recently proposed the working definition of clinical reasoning as: "a non-linear, recursive cognitive process in which the clinician collaboratively synthesizes information with the patient, caregivers, health care team, the task and the setting, and reflectively integrates information with previous knowledge in order to take deliberate action to formulate goals and health management" (Clinical Reasoning Research and Curricula Consortium, 2012). The process of clinical reasoning encompasses how a healthcare practitioner's knowledge is translated into patient care (Barrows & Feltovich, 1987), yet many factors, including beliefs and models of practice, influence what resources a practitioner uses during rapid decision making (Schoenfeld, 2010). Additionally, this iterative process requires clinicians to make decisions and continually

re-assess actions taken in the face of uncertainty (Barrows & Feltovich, 1987; Higgs & Jones, 2008). This highly context-dependent process requires both formal and informal strategies and ongoing interaction with the patient (Higgs & Jones, 2008; Simmons, 2010). In order to function as autonomous professionals, physical therapists must develop effective clinical reasoning skills (Brookfield, 2008; Simmons, 2010). To prepare students for autonomous practice, entry-level PT educational programs need to promote the development of students' clinical reasoning skills, yet to date there is little consensus on how best to approach this task. I propose that in order to effectively teach physical therapy specific clinical reasoning, we need a greater understanding of how students develop their clinical reasoning skills and the programmatic features that influence this development.

Importance of Clinical Reasoning Specific to Physical Therapy

Few studies have addressed teaching practices to best facilitate PT students' development of clinical reasoning skills. More studies have addressed the issue of diagnostic reasoning in medical students (Coderre, Jenkins, & McLaughlin, 2009; Norman, 2005; V. L. Patel & Groen, 1991), but three key differences in physical therapy practice suggest the need to examine teaching strategies specific to physical therapy clinical reasoning. First, the diagnostic process is only one aspect of the clinical reasoning process for physical therapists (Jones, 1992). Studies of medical reasoning have focused primarily on diagnostic reasoning at the level of identifying the active pathology (medical diagnosis) (Bordage, Grant, & Marsden, 1990; Coderre et al., 2009; Elstein, Shulman, & Sprafka, 1978; Norman, 2005; V.L. Patel & Groen, 1986; V. L. Patel & Groen, 1991). Within physical therapy practice, however, diagnostic reasoning must not only identify the active pathology but also identify the reason for the problem and the consequences of illness/disease process (Christensen, Black, & Jensen, 2013; A. M. Jette, 1989; Rothstein,

Echternach, & Riddle, 2003). Physical therapists' analysis of contributing factors typically focuses on the second unique factor of PT clinical reasoning, the analysis of movement (Jones, 1992; Rothstein et al., 2003). The analysis of movement is central to experienced PTs' clinical reasoning processes (Jensen, Gwyer, Shepard, & Hack, 2000). This focus on movement and understanding movement patterns and their role in normal and pathological function is central across multiple PT practice settings, including pediatrics (Embrey, Guthrie, White, & Dietz, 1996), neurology (McGinnis, Hack, Nixon-Cave, & Michlovitz, 2009; Riolo, 1996; Wainwright & McGinnis, 2009), and orthopedics (S. May, Greasley, Reeve, & Withers, 2008). Physical therapists must also consider contraindications and precautions to movement as they approach their examination and treatment with patients (Jones, 1992). Third, due to the ongoing and interactive nature of therapeutic work, concurrent with evaluating and developing strategies to address the patient's problems, the therapist ought to work collaboratively with the patient to determine ways to engage and motivate the patient in the treatment process (Mattingly, 1991; Wainwright & McGinnis, 2009). This interactive process includes gaining an understanding of the patient's context and perspective on the illness or injury (Christensen et al., 2013; Jensen, 2011). Education for clinical reasoning physical therapy should address these unique characteristics in addition to the diagnostic process.

Overview of the Study

In this dissertation study I extend our understanding of how entry-level physical therapist students develop their clinical reasoning skills across educational programs. I address this issue by answering four primary research questions: 1) How do PT students characterize physical therapy practice? 2) During an encounter with a patient, what clinical decisions do PT students make, and what clinical reasoning strategies underlie their decisions? 3) What is the relationship

between PT students' characterizations of practice and their clinical decisions? And 4) Do PT students' clinical decisions and reasoning strategies vary across educational programs?

I collected data from students in two entry-level physical therapist educational programs in Southern California. The primary data sources were PT students' responses to interview questions concerning their conceptualizations of practice (Dall'alba, 1998, 2002, 2004) and PT students' performance on and explanations of a standardized patient case (Durning et al., 2012; Peabody, Luck, Glassman, Dresselhaus, & Lee, 2000). Few studies have addressed the characteristics of clinical reasoning capacities of PT students prior to completion of their entry-level programs (Babyar et al., 2003; Doody & McAteer, 2002; Hendrick, Bond, Duncan, & Hale, 2009; James, 2007), and even fewer have compared aspects of PT students' reasoning across programs (Huhn, Black, Jensen, & Deutsch, 2013).The findings of this study extend our current understanding of PT students' clinical reasoning abilities by not only examining the strategies employed by students during a clinical reasoning case and their conceptualizations of PT practice, but also analyzing differences in students' approaches to clinical reasoning across academic programs. Physical therapist educators currently lack established benchmarks for student clinical reasoning (Jensen, 2011), and have very little research to guide curricular design for physical therapist education (Deusinger, 2011; Peterson & Sandholtz, 2005; Portney, 2011; Spake & Salem, 2005). This dissertation advances our understanding of students' approaches to clinical reasoning and the educational program factors that may influence their development.

Significance

To date, there has been little work addressing how to bridge what is known about expertise and expert practice with entry-level educational practices for instruction and assessment of clinical reasoning (Norman, 2002). Currently, entry-level physical therapist

educators lack consensus on what constitutes clinical reasoning and describe even greater variation in approaches to teaching it (Black et al., 2015). To effectively prepare entry-level physical therapist students for autonomous practice, entry-level educational programs must support students in developing their clinical reasoning skills. Few studies, however, have addressed curricular development in PT education (Broberg et al., 2003; Weddle & Sellheim, 2009). Further, there are few studies of PT educational practices to provide guidance on how to translate educational innovations from research into classroom practice (Gwyer & Hack, 2012). The findings from this study point to curricular design principles that may better support students' development of clinical reasoning skills.

Overview of Chapters

The ensuing chapters of this dissertation describe the background, methods, findings and significance of this study. Chapter 2 begins by describing the theoretical foundation for this study, informed by the current literature on clinical reasoning and professional development in physical therapy. Chapter 3 describes the methods, beginning with a description of the sites and participants followed by the data collection sessions (interviews and standardized patient activities). Chapter 3 then describes the analysis used to address each of the four research questions. Chapter 4 begins the presentation of the findings with descriptions of the students' characterizations of practice and factors that influenced their views on practice. Chapter 5 presents the findings of the types of clinical decisions and reasoning strategies the participants employed during their encounter with the standardized patient. This chapter includes analyses of the types of hypotheses and reasoning strategies the students employed, in addition to the types of reflection they engaged in during the encounter. Chapter 6 draws on the findings presented in the prior two chapters and explains the relationship between the students' characterizations of

practice and their actions during the clinical encounter. Chapter 7 describes similarities and differences in the characterizations and practices of students from the two programs. Finally, Chapter 8 presents a revised model of clinical reasoning using the findings from this study to build on the theoretical framework presented in Chapter 2. Chapter 8 further describes the educational implications of the findings from this study and the revised model for clinical reasoning.

Chapter 2

Theoretical Framework

The theoretical framework for this dissertation draws on Edwards & Jones' (2007) model of clinical reasoning in physical therapy that defines clinical reasoning as a dialectic of narrative and empirico-analytical reasoning within the context of the clinical setting and the patient's life. Researchers have identified eight primary types of reasoning strategies employed by experienced physical therapists during their encounters with patients (Edwards, Jones, Carr, Braunack-Mayer, & Jensen, 2004) (See Table 2.1). Clinicians engage two of these strategies, diagnostic reasoning and narrative reasoning, during the diagnostic process, while they draw on the remainder during the treatment process. Additionally, the PT must integrate ethical reasoning, the consideration of dilemmas that impinge on treatment, and assessment of best action, throughout all of the reasoning processes (Edwards & Jones, 2007; Edwards, Jones, Carr, et al., 2004). Building on Edwards and Jones' (2007) framework, I describe four underlying capacities necessary for effective clinical reasoning and propose a new perspective for studying students' development of clinical reasoning skills.

Table 2.1: Clinical reasoning strategies (adapted from Edwards, Jones, Carr, et al., 2004)

Collaborative Reasoning	Building a consensual approach towards goal setting and treatment planning
Diagnostic Reasoning	Determining the active pathology, impairments, functional limitations, and contributing factors
Ethical Reasoning	Considering dilemmas that impinge on treatment and assessing the best action
Interactive Reasoning	Establishing and maintaining the patient-practitioner relationship
Narrative Reasoning	Seeking to understand the patient's understanding of his/her condition
Predictive Reasoning	Envisioning and evaluating future scenarios and the role of patient and PT choices
Reasoning about Procedures	Determining and carrying out the appropriate interventions
Reasoning about Teaching	Determining content and approach to patient education and assessing outcomes of education

Capacities Required for Clinical Reasoning

Edwards & Jones' (2007) model describes clinical reasoning in experienced clinicians. I propose that four primary capacities underlie the ability to successfully engage in this mode of reasoning. First, clinical reasoning requires a well-organized knowledge base and content-specific deductive reasoning skills (Higgs, 1992). Second, clinical reasoning requires the ability to effectively interact with patients (Hayward et al., 2013; Higgs, 1992). Third, clinical reasoning requires the ability to manage decision making in a context of uncertainty (Hayward et al., 2013; Shepard & Jensen, 1990). Finally, clinical reasoning as envisioned by the World Health Organization (World Health Organization, 2002) and the American Physical Therapy Association (APTA) (American Physical Therapy Association, 2012) requires a patient-centered, biopsychosocial orientation to practice (Schoenfeld, 2010; Trede & Higgs, 2008). Figure 2.1 depicts the relationship between these capacities, and the following section describes these capacities and their role in clinical reasoning in more detail. These capacities contribute to our

understanding of the knowledge, skills, and attitudes that students need in order to develop their clinical reasoning abilities.

Figure 2.1: Capacities Required for Clinical Reasoning

Clinical Reasoning Requires Content Specific Deductive Reasoning Skills

Diagnostic reasoning, predictive reasoning, and reasoning about procedures (selection of treatment) require an appropriate knowledge base and effective problem solving skills. This section addresses the two most prevalent models of clinical problem solving, the hypothetico-deductive model and forward reasoning models. While the hypothetico-deductive model is more prominent in novices (Coderre, Mandin, Harasym, & Fick, 2003; Doody & McAteer, 2002; Wainwright, Shepard, Harman, & Stephens, 2011), experienced clinicians may evidence both forward (pattern recognition) and backward (hypothetico-deductive) reasoning based on content specific knowledge levels (Mandin, Jones, Woloschuk, & Harasym, 1997). Although most

studies indicate expert clinicians draw on forward reasoning strategies (Coderre et al., 2003; Jensen et al., 2000; V.L. Patel & Groen, 1986; Wainwright et al., 2011), they must draw on the hypothetico-deductive process when dealing with areas outside of their expertise. Clinical reasoning requires a complex interaction between a practitioner's problem solving skills and content specific knowledge base (Higgs, 1993).

The hypothetico-deductive model. The hypothetico-deductive model emerged from early studies on medical clinical reasoning, and suggested that a general problem-solving model could be applied to clinical reasoning (Norman, 2005). The basic process of the hypothetico-deductive model involves four steps: cue acquisition, hypothesis generation, cue interpretation, and hypothesis evaluation (Elstein et al., 1978). The concept of hypothesis encompasses a broad range of thought, from diagnostic ideas to any structure/process that may be contributing to the patient's state (Barrows & Feltovich, 1987). Although it is considered a backwards-reasoning model, the hypothetico-deductive process, remains important to physical therapist education, as clinicians must have a general problem solving strategy to resort to when working outside of their areas of expertise (Bowen, 2006; V.L. Patel & Groen, 1986).

Pattern recognition and forward reasoning. Forward reasoning models focus on the organization of knowledge and availability as the determinants of diagnostic reasoning (Bordage et al., 1990). The concept of forward reasoning includes the use of production rules involving if/then propositions (V.L. Patel & Groen, 1986). One element of the forward reasoning models cited by Bordage et al. (1990) is "forceful features" which are elements elicited during the patient interview and examination (observations, statements, test findings) that give rise to pattern recognition in memory structures. Expert health care providers encapsulate knowledge into "illness scripts" that contain complex inter-woven networks of knowledge including

enabling factors for particular diagnostic categories (A. B. de Bruin, Schmidt, & Rikers, 2005; Norman, 1989a, 1989b; V. L. Patel, Groen, & Frederiksen, 1986; Rikers, Schmidt, & Moulaert, 2005; Schmidt & Rikers, 2007). These illness scripts result from the interlinking of biomedical and clinical knowledge networks with specific patient case experience (Mandin et al., 1997; Schmidt, Norman, & Boshuizen, 1990). Within physical therapy practice, experienced clinicians develop movement scripts and engage in movement analysis through a pattern recognition process (Embrey et al., 1996; McGinnis et al., 2009).

Overall, physical therapist educators must be aware of the role of both the hypothetico-deductive and forward reasoning processes. Entry-level education should support students in developing a sufficient knowledge base that is adequately organized and integrated for them to draw on during complex clinical situations. This effective knowledge organization starting from their foundational classes can support students in their development of "illness scripts" for content specific reasoning. Programs, however, also need to equip students with more generalized problem-solving strategies such as the hypothetico-deductive process so that they can address unfamiliar situations. Knowledge and problem solving alone, however, are insufficient for clinical practice. Clinical reasoning must happen within the context of the patient's life and thus students must also be able to integrate this problem solving with appropriate interpersonal interactions with the patient.

Clinical Reasoning Requires Effective Interactions with the Patient

In the changing world of healthcare, PTs need to be interactional: empowering clients to be active in their own healthcare for quality of life and well being (Higgs, Hunt, Higgs, & Neubauer, 1999). At a minimum, during the initial session with a patient, the PT must interact with the patient in order to gather information, develop a relationship, and communicate

information (Roberts, Whittle, Cleland, & Wald, 2013). The complexity of physical therapy practice contexts requires integration of a wide variety of knowledge sources, including the patient's own knowledge (Edwards & Richardson, 2008). Physical therapists must be prepared to address issues that go beyond the tissue pathologies and biomechanics, as most patients in physical therapy present not with isolated physical conditions, but with physical conditions that impact their sense of identity and psychic well-being (Parry, 1997). For these patients, deductive reasoning alone will fail to address their needs (Daykin & Richardson, 2004). Practitioner-patient interactions may affect patients' perceptions of the effectiveness of interventions and the ultimate success of those interventions (M. D. Bishop, Mintken, Bialosky, & Cleland, 2013; Ferreira et al., 2013). Specifically, enhanced patient-practitioner interactions can contribute to increased pain reduction in patients with chronic back pain (Fuentes et al., 2014). Technique and knowledge alone cannot prepare a health care professional for the interactional needs of working with individuals with injuries and illness (Benner, 2004); clinicians must develop competencies in interacting with the people they care for. Within clinical practice, two critical arenas of interaction with the patient include narrative reasoning and collaborative reasoning.

Engaging in narrative reasoning enables the clinician to better understand the patient's context and bring a more holistic approach to care (Benner, 2000). These processes require that the clinician establish rapport with the patient and have the perceptual acuity to understand all forms of the patient's communication (Benner, 2000). The clinician must be open to recognizing that each patient attributes meaning to his/her situation in an individual and context specific way (Edwards & Richardson, 2008). The PT cannot assume a shared understanding of the situation, and must engage in ongoing active listening to gain an appropriate understanding (Edwards & Richardson, 2008). Physical therapists must not only gain an understanding of the patient's

narrative "story," but they must also engage the patient in collaborative problem solving, forming a joint understanding of the problem and drawing on the patient's preferences and values in developing treatment options (Edwards, Jones, Higgs, Trede, & Jensen, 2004). Engaging in this shared decision-making requires certain skills and knowledge in effective interaction including responsiveness to the patient's subtle cues during the interaction (Bernabeo & Holmboe, 2013; Jensen, Shepard, & Hack, 1990). To effectively engage patients in their own care, health care practitioners need to develop an awareness of each patient's specific needs and beliefs (Hibbard & Greene, 2013; Mattingly, 1991, 1998). Experienced practitioners do not separate the constructivist narrative process from the clinical problem solving process (Edwards, Jones, Carr, et al., 2004).

Clinical Reasoning Requires Reflection for Decision Making in a Context of Uncertainty

Analytic deductive reasoning and interaction skills alone do not prepare a clinician for the uncertainty inherent in addressing the complexity of real world clinical patient care. Patient cases are ambiguous by nature; thus clinical reasoning requires practitioners to develop a reasoning framework when not all the facts are known (Barrows & Feltovich, 1987). This lack of explicit structure requires the clinician to set the problem and determine what to attend to prior to solving the problems presented (Schon, 1987). The ambiguity inherent in clinical decision-making also typically includes conflicts of values (Tanner, 2006). In light of these ambiguities and value conflicts, clinical judgments do not represent objective technical problem solving based on concrete facts (Greenhalgh, 1999). Rather, clinical reasoning occurs in the "indeterminate zone of practice" that entails navigating uncertainty and value conflicts, not the direct application of rules or techniques (Schon, 1983, 1987). Regardless of how much research evidence is accumulated, clinicians will always ultimately have to make a decision and that

requires an element of uncertainty (West & West, 2002). To deal with this context of uncertainty, practitioners must engage in reflection in and on action and develop flexibility in their practice (Schon, 1983).

Clinical reasoning within these uncertain contexts is a spiral process involving cognition, metacognition and knowledge (Hendrick et al., 2009). Reflection in action, an ongoing metacognitive awareness, allows the clinician to adapt the reasoning process in response to unfolding outcomes in process (Schon, 1983; Wainwright, Shepard, Harman, & Stephens, 2010). This practice of reflection in action is particularly important when a practitioner encounters a situation in which the initial actions taken do not result in the expected outcome (Schon, 1983). Further, reflection in action enables experienced PTs to vary their responses to the immediate patient's needs rather than depending on set protocols (Embrey et al., 1996; Rushton & Lindsay, 2010; Smith, Higgs, & Ellis, 2008a; Unsworth, 2001). This flexibility in reasoning is crucial for therapists who encounter social or organizational barriers to their desired actions (Johns, 1995). Reflection on action, that is, looking back and analyzing prior actions (Schon, 1983), enables physical therapists to learn from their experiences and integrate these experiences into their present work. This practice of reflection is crucial for clinicians to examine their assumptions and biases in order to question the effectiveness of routine aspects of care, anticipate problems and consider alternative approaches (Anderson & Funnell, 2005; Donaghy & Morss, 2007; Embrey et al., 1996). Reflection on action, not experience alone, is what enables clinicians to continue to learn from their practice (Shulman, 2004). Reflection both in and on action can help clinicians develop more flexible approaches to clinical reasoning, critical skills in the ever-changing context of patient care.

Clinical Reasoning Requires a Patient-Centered Orientation to Practice

A physical therapist's beliefs and orientations about effective practice influence how he/she actually draws on capacities for reflection, deductive reasoning, and patient interaction in practice (Edwards, Jones, & Hillier, 2006; Schoenfeld, 2010; Smith, Higgs, & Ellis, 2008b; Trede & Higgs, 2008). In physical therapy, two primary views of practice predominate: the biomedical (application of biomedical science to cure problems) and the biopsychosocial (considering the interaction of physical, psychological, and social) (Daykin & Richardson, 2004; Stenmar & Nordholm, 1994). A clinician practicing from a patient-centered biopsychosocial approach integrates respect for the patient's whole life in collaborative problem solving and seeks to find a common ground with the patient to work from (Lewin, Skea, Entwistle, Zwarenstein, & Dick, 2001; Stewart, 2001). A clinician practicing from the biomedical model, however, will privilege analytical reasoning over collaborative reasoning with concern for the patient's values and life experience (Edwards et al., 2006). Not all physical therapists or PT students, however, conceptualize practice from a patient-centered, biopsychosocial perspective (Daykin & Richardson, 2004; Hendrick et al., 2009; Lindquist, Engardt, Garnham, Poland, & Richardson, 2006; B. Richardson, Lindquist, Engardt, & Aitman, 2002). These variations in conceptualizations have implications for clinical reasoning.

During an encounter with a patient, what the health care practitioner attends to depends on his/her values and philosophical orientations (Smith et al., 2008a; Tanner, 2006). In medical practice, the physician or medical student's orientation to the patient-practitioner relationship influences what he/she considers acceptable to discuss with the patient (Dall'alba, 2002). The lens through which students view their profession influences what features are given attention, the types of problems they choose to address and the methods deemed appropriate for solving

problems (B. Richardson, 1999b). In order to engage in collaborative/shared decision-making, clinicians must believe that the patient has an active role in the process, and the health care practitioner must have an attitude that allows for patient engagement in the process (Bernabeo & Holmboe, 2013; Edwards, Jones, Higgs, et al., 2004; Edwards & Richardson, 2008). Further, health care practitioners must have awareness and recognize the influence of their beliefs and values on their relationship with the patient in order to engage in patient-centered reasoning (Atkins & Ersser, 2008). Beyond the information collected, a physical therapist's orientation to practice influences the balance of analytical and collaborative reasoning he/she engages in.

Summary

Experienced clinicians integrate the four capacities of content-specific analytic reasoning, interactions with the patient, decision-making under uncertainty, and patient-centeredness to provide effective care for patients with diverse needs (Jensen et al., 2000; Shepard, Hack, Gwyer, & Jensen, 1999). I propose that examination of PT students' clinical reasoning abilities should include assessment of these four capacities. Gaining a greater understanding of how PT students draw on and integrate these four capacities during their work with a patient can enhance our understanding of how PT students develop their clinical reasoning abilities.

Development of Clinical Reasoning Skills and Educational Program Structure

Effective education for the development of clinical reasoning should address the capacities required for effective reasoning (Higgs, 1992). As such, entry-level physical therapy education should address efficient knowledge organization, along with the integration of reflection and patient interaction. These capacities should be developed with concurrent attention to students' orientations to practice, as a lack of alignment between elements may promote disconnections in students' development of reasoning abilities.

The current educational literature on clinical reasoning addresses three broad categories of pedagogical practices for teaching clinical reasoning: (a) Cognitively directed teaching strategies including methods of content integration and the inclusion of case studies in classroom teaching (Beck & Bergman, 1986; A. B. de Bruin et al., 2005; Eva, 2004); (b) Explicit teaching of clinical reasoning strategies in isolated clinical reasoning courses (Burnett & Pierson, 1988; Higgs, 1990) or clinical coursework and internships (Bowen, 2006; Crandall, 1993; Goss, 1996; Kelly, 2007); and (c) The use of narrative and reflection in either classroom or clinical activities (Brady, Corbie-Smith, & Branch, 2002a; Donaghy & Morss, 2000, 2007; Jensen & Paschal, 2000). Each of these categories supports elements of the clinical reasoning process, but these teaching strategies in isolation leave disconnections between the classroom and clinic and gaps in students' overall understanding of the reasoning process. A critical factor in the limitations of the current approaches to teaching clinical reasoning stems from the "clinical research" approach. Most studies have designed a single "intervention" and assessed the impacts of that one intervention. While these studies have contributed to our understanding of components of the learning process in the development of clinical reasoning, we do not yet fully understand how they all work together for the most effective teaching of clinical reasoning skills.

Clinical reasoning underlies all of physical therapy practice, and thus overall program structure likely exerts a greater influence on students' development of clinical reasoning skills than individual classroom or clinical experiences. Innovations at the level of an individual course or clinical experience can provide insights into the factors that contribute to students' learning. A shift from the study of individual courses or "interventions" to a programmatic view, though, is needed to fully understand students' development of clinical reasoning skills, as a curriculum for

professional learning needs to be one of continuous growth, not disconnected pieces (Dewey, 1974).

One aspect of physical therapist educational program structure currently under investigation is the timing and placement of clinical experiences. The American Council of Academic Physical Therapy (2014) has identified two primary curricular models for entry-level physical therapist education: integrated (affiliations spread throughout the program) and terminal (affiliations concentrated at the end of the program). Integrated clinical affiliations may provide students with greater opportunities to contextualize ideas learned in didactic courses than do terminal clinical affiliations (Huhn et al., 2013). Examination of students' clinical reasoning in programs with integrated versus terminal clinical curricula can lend greater support to aspects of program structure that best support students' development of clinical reasoning.

The examination of students' perceptions of practice and clinical reasoning strategies is an important initial step towards understanding the complex interaction of the educational program structure and students' development of clinical reasoning capacities. The pedagogical practices described in the literature likely contribute to students' overall development, yet they do not function in isolation. In order to develop effective approaches to teaching clinical reasoning skills, we need an understanding of not only how students' engage in clinical reasoning, but also how their clinical reasoning and understandings of practice vary from program to program.

Chapter 3

Methods

This dissertation examined how physical therapist students conceptualized practice and engaged in clinical reasoning. In particular I assessed students' perspectives on practice, their clinical decisions and reasoning strategies, and the relationship between these constructs. Further, in this study I examined variations across educational programs.

Site Selection

I recruited students from two entry-level physical therapist educational programs. I selected the educational programs based on preliminary differences in their overall program structure. Both programs use traditional (discipline based) curricula but differ in the sequencing of their courses, the types of pre-clinical experiences included, and the scheduling of students' full time clinical experiences. University A and University B were specifically selected for their differences in timing and placement of clinical affiliations. University A uses primarily terminal clinical affiliations while University B uses integrated clinical affiliations. As a result, at the time of this study, students from University A had participated in 6 weeks of clinical affiliations while students at University B had participated in 16-20 weeks. Table 3.1 summarizes the preliminary differences.

Table 3.1: Preliminary program differences

	University A	University B
Course Sequencing	First term includes course on professional interactions	First term is entirely foundational science
	Separate clinical courses for examination and intervention (in separate terms)	Clinical courses address examination and intervention in same course
Timing of Clinical Experiences	Pre-clinical experiences are in integrated onsite clinic Readings on expert practice included	Pre-clinical experiences are two week experiences off site
	Clinical experiences concentrated during third year (Terminal experiences)	Clinical experiences interspersed over second and third years (Integrated experiences)
	Students have had 6 weeks of clinical experience	Students have had 2 2-week pre-clinical experiences and 12-16 weeks of clinical experience

Participant Selection

Within each program I selected students during their second year in the three-year doctoral program. I specifically targeted students who were near the end of their second year in the program to best identify differences due to the influences of program structure. During their first year, students would have had limited time within the program and the impact of the program may not be as pronounced. By the conclusion of their third-year, many students will have been in specific clinical sites for up to nine months, and thus their reasoning may reflect more of the individual clinical sites than of their educational program. Thus, assessing students in the final term of their second year should best reveal any variations due to program structure.

From each program I selected a random sample of four student volunteers to participate in this study. I decided on four participants from each program based on the numbers of participants used in prior studies of expert-novice differences in physical therapy practice (Wainwright et al., 2010, 2011). Within the selection process, I ensured that at least one participant (25%) from each program was male, based on the gender distribution within the students' classes as a whole.

Participants

The participants at both programs had similar demographics. No participant had prior experience as a PTA or athletic trainer. All participants had prior experiences as PT aides and/or volunteers. Most also had personal experience as a patient in physical therapy or with a family member as a patient. Average age at University A (mean age 27 years) was slightly higher than University B (mean age 25.25 years). Participants expressed interest in a variety of physical therapy practice settings, but the spectrum of practice areas was evident across both programs. Table 3 summarizes the demographic information of the participants.

Table 3.2: Participant demographic information

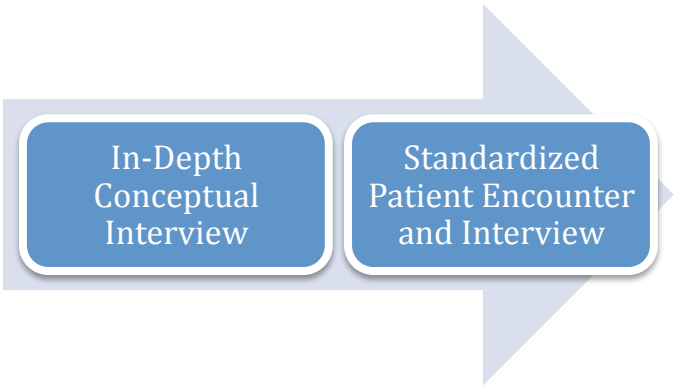
	Name	Age/ Gender	Clinical Experience	Pre-PT Clinical Experience	Other Work Experience
University A	**Bethany**	27 Female	• Integrated neurological clinic • Outpatient orthopedics (6 wks)	• Hospital/rehab volunteer • MDA camp volunteer • Outpatient orthopedics aide (1 yr)	• Restaurant service • Research assistant • Peer advisor
	Mason	27 Male	• Integrated neurological clinic • Outpatient orthopedics (6 wks)	• Outpatient orthopedics aide (6 years, 2 clinics)	• Food service • Retail
	Kelly	25 Female	• Integrated neurological clinic • Outpatient orthopedics (6 wks)	• Outpatient orthopedics volunteer • Volunteer at Rehab Hospital	• Water polo coach
	Chloe	29 Female	• Integrated neurological clinic • Inpatient hospital (6 wks)	• Outpatient orthopedics aide (4.5 years)	• Interior design • Gym coordinator • Organic orchard
University B	**Peter**	27 Male	• Outpatient orthopedics & neurology (12 wks) • Stroke boot camp (2 wks) • Outpatient orthopedics (2 wks)	• Outpatient orthopedics aide (2 yrs, 2 clinics)	• Customer service • Food service • Basketball coach
	Lisa	26 Female	• VA outpatient orthopedics (8 wks) • Outpatient orthopedics (private clinic) (8 wks) • Inpatient rehabilitation (2 wks) • Pediatrics (2wks)	• Observation: orthopedics and pediatrics • Volunteer at inpatient hospital	• Corporate sales • Nanny/babysitting • Gym front desk • Event hostessing
	Sophia	24 Female	• VA outpatient orthopedics (8 wks) • Private outpatient orthopedics (8 wks) • Outpatient orthopedics (2 wks) • Outpatient orthopedics & vestibular (2 wks)	• Hospital volunteer: inpatient rehabilitation and skilled nursing • Acute care volunteer • Outpatient orthopedics aide	• Dorm residence Assistant (RA) • Food service • Event hostessing
	Hannah	24 Female	• Hospital based outpatient orthopedics (12 weeks) • Pediatrics (2 wks) • Outpatient orthopedics (2wks)	• Outpatient orthopedics (private clinic) • Hospital based outpatient orthopedics	• Kitchen work • Server/hostess in food service • Hair and make-up work

Data Collection

Each participant participated in two separate data collection sessions. In the first session each participant completed an in-depth interview, and in the second session each participant completed a standardized patient assessment and interview. I describe each session in more detail

in the following sections. I compensated each participant with a $50 Amazon gift card at the completion of the final data collection session. I conducted all data collections sessions on campus at the participants' programs. Figure 3.1 demonstrates the sequence of data collection sessions.

Figure 3.1 Sequence of data collection sessions



Conceptual Interviews

In the first data collection session, I conducted an in-depth semi-structured interview with each participant. These interviews focused on the students' conceptualizations of and experiences with physical therapy practice. Within the interview, I specifically asked students to describe a concrete patient example that they considered to be representative of a typical physical therapy patient and one that that they felt would be very challenging. These questions follow closely from prompts previously used during interviews to explore medical students' and clinicians understanding of medical practice (Dall'alba, 1998, 2002, 2004; Holmstrom, Halford, & Rosenqvist, 2003; Holmstrom & Rosenqvist, 2001) and novice physical therapy clinicians' perceptions of their practice (Lindquist et al., 2006; B. Richardson et al., 2002). In addition to describing concrete patient experiences, I asked participants to give a metaphor for the work of a physical therapist. Metaphors represent an expression of individuals' thought processes and provide insight into individuals' tacit theories about their professional practice (Lakeoff &

Johnson, 1980; Martinez, Sauleda, & Huber, 2001; Thomas & Beauchamp, 2011). I also asked students to complete a resume sort wherein they named the experiences they have had with physical therapy and sorted these experiences based on how those experiences influenced their understanding of physical therapy. (See Appendix A for interview guide)

The final component of the interview was a modified Q-sort. During the Q-sort, the participant classified a set of descriptive statements according to degree of application to a specific situation (Akhtar-Danesh, Baumann, & Cordingley, 2008; Barker, 2008; Valenta & Wigger, 1997) For this study, I selected the Q-sort concept statements based on analysis of existing literature and my pilot data (Barker, 2008; Jensen et al., 1992; Lindquist et al., 2006). These statements represent actions physical therapists might take and concepts they might consider during their work with a patient. I conducted further pilot testing of the Q-sort statements with experienced orthopedic and neurologic physical therapists to ensure that I was not missing any critical concepts. For this study I used a modified Q-sort and asked the participants to rank their top and bottom three concepts (Jacobson, 1980). I then asked each participant to explain his/her rationale for placing those concepts in his/her top and bottom three. (See Appendix A for Q-sort list)

Standardized Patient Encounter and Interview

In the second data collection session, I used a standardized patient encounter and post-encounter interview to examine entry-level physical therapist students' clinical decisions and clinical reasoning strategies during an orthopedic patient encounter. A standardized patient is a healthy individual trained to portray a specified musculoskeletal injury (Peabody et al., 2000).

Rationale for method. Although researchers have not identified a single best method for assessing clinical reasoning (Huhn, Black, Jensen, & Deutsch, 2011; Schuwirth, 2009),

researchers have employed four primary research methods for investigating clinical reasoning: 1) Naturalistic clinical observations (Hayward et al., 2013; Jensen et al., 1992; Wainwright et al., 2011), 2) Lab based knowledge-based tasks (step by step case studies) (Boshuizen & Schmidt, 1992; Coderre et al., 2003), 3) Cognitive assessments (Bordage et al., 1990; Charlin, Roy, Brailovsky, Goulet, & van der Vleuten, 2000), and 4) Standardized patients (Durning et al., 2010; Peabody et al., 2000; Prislin, Lie, Shapiro, Boker, & Radecki, 2001).

Each of these prior methods has its own strengths and limitations, but due to the complexity of clinical reasoning, using multiple assessment methods produces a better picture of the participant's overall capacity (Huhn et al., 2011). Naturalistic clinical observations allow insight into how clinicians engage in clinical reasoning in context. For three reasons, however, this is not feasible for the study of physical therapist students' reasoning. First, beginning students lack the skills to assess a patient autonomously in the clinic and thus would require instructor intervention that would affect the findings of the study. Second, asking a student to assess a patient prior to adequate training would place the patient's safety at risk. Finally, scheduling individual clinical observations with students at multiple sites would require coordination of an extensive number of clinics that is not feasible for this stage of research.

Most laboratory studies have used paper case studies and focused on the participants' cognitive processes. These assessments provide extensive information regarding the cognitive/diagnostic aspect of clinical reasoning, but they do not allow sufficient assessment of participants' interactions with the patient. Research in clinical reasoning in physical therapy indicates that experienced physical therapists integrate diagnostic reasoning with narrative relationship building with the patient (Edwards & Jones, 2007; Jensen et al., 2000).

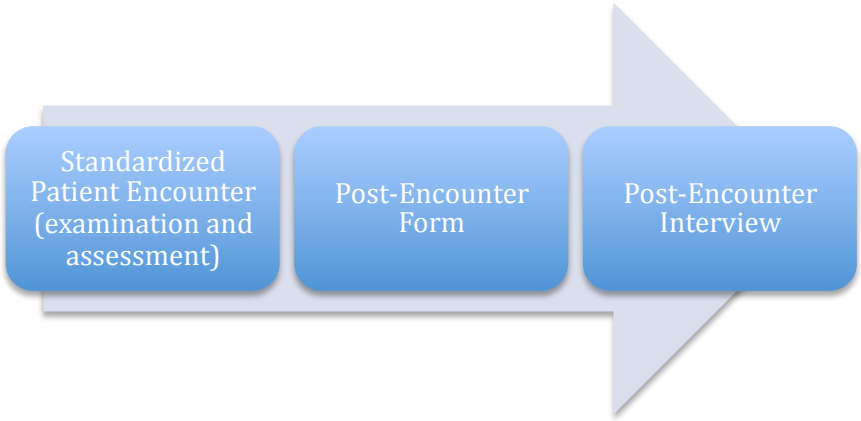
The use of standardized patients allows a controlled examination of participants' reasoning processes while preserving the interactive nature of the task. While many studies have assessed clinical reasoning and patient-practitioner interactions in medical students using standardized patients (Durning et al., 2012; Durning et al., 2010; Peabody et al., 2000; Prislin et al., 2001), few studies have integrated this method into the study of physical therapist students' clinical reasoning (Ladyshewsky, Baker, Jones, & Nelson, 2000). The use of a standardized patient allows for examination of both the cognitive (through a retrospective think-aloud) and interactive elements of clinical reasoning in an environment that is safe for beginning level students.

Standardized patient encounter. The first task participants completed during the second data collection session was the standardized patient (the patient) encounter. The patient encounter entailed the participant conducting a physical therapy examination on and forming a physical therapy assessment of the patient. The patient was a healthy individual who had been trained to portray the specified musculoskeletal injury, and the same patient was used for all participants to ensure consistency across participants. Prior to meeting the patient, I presented the participant with the instructions and gave the participant the patient's referral information (see Appendix B). I instructed the participant to conduct the examination with the patient as if he/she were assessing a new patient in a physical therapy clinic. I instructed the participant to proceed to his/her first treatment when he/she completed the assessment. If the participant had not completed his/her assessment in 35 minutes, I instructed him/her to proceed to the treatment phase.

The participant did not complete the full treatment for the safety of the standardized patient, as the treatment identified for the patient in the case may not have been appropriate for

the actor portraying the patient. Once the participant had initiated the treatment, I instructed him or her to proceed to concluding the session with the patient. The conclusion of the session could include any instructions the participant wishes to give the patient on follow up or home activities. The interactions of the participant and the patient during the encounter were video and audio recorded. I took notes on the participant's actions during the patient encounter to guide the post-encounter interview. The duration of the patient encounters ranged from 20 to 40 minutes, similar to initial assessments in many clinics (Roberts et al., 2013). Figure 3.2 depicts the sequence of activities during the data collection session.

Figure 3.2: Sequence of second data collection session



Post encounter form and interview. Following the patient encounter, the participant completed the "Post Encounter Form" (see Appendix C, adapted from Durning et al., 2012) describing his/her assessment of the patient and his/her reasoning process. Immediately after the participant completed the "Post Encounter Form," I interviewed the participant regarding his/her reasoning processes during the patient encounter (see Appendix D for interview guide). The first portion of the interview included a review of the patient session where I asked the participant to describe his/her thought process underlying each action taken during the encounter. All interviews were audio recorded.

Development of the standardized patient case. I used the literature on training standardized patients to inform the development of the case for this study (Wallace, 2007). I designed the case around a patient with sacroiliac joint dysfunction. Sacroiliac dysfunction is an orthopedic complaint common in physical therapy practice (Cibulka, 1992) for which specific provocation tests may give unclear/unreliable findings (Slipman, Sterenfeld, Chou, Herzog, & Vresilovic, 1998), and pain patterns can be highly variable (Slipman et al., 2000). These factors create uncertainty within a scripted case. Further, sacroiliac joint dysfunction may be particularly effective for a standardized patient case, as provocation tests, not static position or palpated motion may be the best indicator of pathology (symmetry does not rule out pathology, nor does asymmetry guarantee pathology) (Dreyfuss, Dryer, Griffin, Hoffman, & Walsh, 1994; Walker, 1992). The specific biomedical details of the case were informed by the literature on sacroiliac joint dysfunction, including the patient's description of the pain (Cibulka, 1992; Slipman et al., 2000; van der Wurff, Buijs, & Groen, 2006), aggravating and alleviating factors (Cibulka, 1992), and responses to provoking tests (Cibulka, 1992; Laslett, Aprill, McDonald, & Young, 2005).

Beyond the biomedical aspects of the case, I designed factors in the patient's lifestyle and history to provide opportunities for participants to draw on ethical reasoning, interactive reasoning, narrative reasoning, collaborative reasoning, reasoning about teaching, reasoning about procedures, and predictive reasoning. Specifically, information within the case pointed to the patient's financial situation and possible ethical conflicts of asking the patient to commit to a "typical" multi-visit course of physical therapy. The case also provided information regarding the patient's career and family life and the patient's experience of the current injury. Training for the standardized patient included specific instructions regarding how much information to

freely share and what information requires further questioning from the participant (Wallace, 2007). Appendix B contains the complete patient case description and Appendix E describes the training procedures for the standardized patient, based on Wallace's (2007) recommendations. During the final practice session with a novice clinician (recent graduate / physical therapy license applicant (PTLA)), the standardized patient accurately represented the case and appropriately responded to all of the PT's questions. Additionally, the PTLA made the appropriate diagnosis (Sacroiliac joint dysfunction), as had the two prior third-year students who had participated as part of the standardized patient's training process.

Analyses

All audio recordings from the conceptual interview (data collection session 1) and patient encounter and interview (data collection session 2) were transcribed verbatim. All transcripts were loaded into DeDoose qualitative analysis software (http://www.dedoose.com/) for coding.

Analysis of Characterizations of Practice

To examine the students' characterizations of practice, I coded their conceptual interviews (data collection session 1) using a process of structural coding (Saldana, 2009) informed by the current literature. Drawing on the existing literature (Dall'alba, 1998, 2002) and my pilot studies (Gilliland, 2012; Gilliland & Fischer, 2014), I defined four coding domains to analyze participants' conceptualizations of practice based on their responses to the interview questions. These domains and the categories within each category are listed in the tables in Appendix F, along with example quotations from the data. The first domain, *Purpose of the Encounter*, was derived directly from Dall'Alba's (1998, 2002) categories established in medical students and clinicians. This domain classified the response based on the indicated types of interactions expected and types of issues addressed in a patient-practitioner encounter. The

second domain, *End Goal of Practice,* was derived from my pilot data (Gilliland, 2012; Gilliland & Fischer, 2014). Participants in these studies varied as to whether they identified the purpose of physical therapy practice as focused on the patient's physical function and impairments, life roles, or psychological status. The third domain, *The Nature of Knowledge in the Encounter,* was derived from both Dall'Alba's (1998, 2002) analyses and my pilot studies. Participants' responses indicated whether they placed the highest value on the practitioner's biomedical knowledge, the patient's knowledge alongside the practitioner's, or the process of interaction between the practitioner and patient. Finally, the domain, *The Patient's Role,* was derived from my pilot data. Participants' responses tended to indicate whether they expected compliance from the patient, or whether the patient had some level of autonomy within the encounter and treatment process. Use of this coding system during prior investigations has yielded inter-rater pairwise agreement ranging from 70% to 79% with Cohen's kappa ranged from 0.55 to 0.65 (Gilliland, 2012; Gilliland & Fischer, 2014).

I investigated convergence of students' responses to the interview questions specifically examining whether their descriptions from concrete examples paralleled the metaphors and roles they described more generally. Further, I compared the students' concrete descriptions of specific patient encounters with their hypothetical description of the role of the patient to identify differences in the students' tacit and explicit theories of practice.

I drew on participants' Q-sort data as an additional source of triangulation. First I examined which items students ranked highest and lowest. Then I compared the Q-sort data alongside the other analyses to provide greater overall description of students' conceptualizations of physical therapy practice.

Finally, I analyzed participants' descriptions of the experiences that influenced their views on physical therapy for type of experience and the nature of its influence. Specifically I examined patterns of how students perceive that each type of experience influenced their views on practice.

Analysis of Clinical Reasoning and Decision Making

Transcripts from the patient encounter were coded to indicate the participant's and the patient's actions alongside the verbal exchange. In the first stage of coding, I used structural coding (Saldana, 2009) to identify the participant's actions during the patient encounter, interactions with the patient, hypotheses formed, and interventions selected. I coded each participant's actions/decisions during the patient encounter based on the elements of physical therapy examination (American Physical Therapy Association, 2003). I created sub-codes within the coding categories to allow more specific description of the examination data the participants collected (see Appendix G: Tables 1A and 1B for codes). I coded each participant's verbal interactions with the patient using the categories developed by Jensen, Shepard, and Hack (1990). I adapted this coding scheme to include one additional code (clarification/confirmation) that emerged from the data (see Appendix G: Table 2). From the retrospective think-aloud, I coded each participant's statements of diagnostic ideas, contributing factors, and judgments as hypotheses (Barrows & Feltovich, 1987; Jones, Jensen, & Edwards, 2008). The coding categories for the hypotheses were derived from Jones et al.'s (2008, p. 253) hypothesis categories, with additional codes emergent from the data (see Appendix G: Table 3). I further analyzed the participants' patterns of hypothesis formation by examining the patterns of code co-occurrences (two codes applied to the same text block). From the patient encounter, post-encounter form, and interview, I categorized the participant's selected treatment interventions

based on the physical therapy interventions described by the American Physical Therapy Association (American Physical Therapy Association, 2003) (See Appendix G: Table 4). I also coded each intervention based on the dimension of the International Classification of Functioning (ICF) (World Health Organization, 2002) the intervention addresses (impairment, activity or participation).

To enhance the credibility and consistency of these findings, a random sub-sample of the data were coded by a second coder trained on the coding system. The primary investigator and the second coder achieved 97% agreement (kappa .964) for coding of clinical actions and 72% agreement (kappa 0.69) for coding of hypotheses. Further, each participant confirmed his/her actions during the post-encounter interview.

In the second stage of coding, I examined the relationship of the hypotheses participants formed, examination data collected, and actions taken to identify their reasoning strategies. I coded the reasoning strategies based on the strategies defined by Edwards et al. (2004, p. 322). I created sub-codes within the reasoning categories to provide more specific categorization of the participants' thought processes (see Appendix G: Table 5 for reasoning codes). A random sample of the data was coded by a second coder trained on the coding system. The primary researcher and the second coder achieved 90% agreement (kappa 0.88) in coding.

Alongside the reasoning strategies, I analyzed each participant's explanations during the retrospective think-aloud for evidence of reflection in- and on-action (Schon, 1983; Wainwright et al., 2010). I analyzed the examination data each participant collected during the patient encounter in relation to the assessment stated in the post-encounter form for thoroughness of examination and logic of conclusions. As part of this analysis, I classified any reasoning errors the participant made based on the nature of erroneous conclusions drawn (Gilliland, 2014). In

this second stage, I also analyzed the relationship of the treatment interventions the participant described to the examination data collected and the participant's stated overall goals for the patient.

Analysis of Relationship of Characterizations and Practice

To examine the relationship between students characterizations of practice and their clinical decision making, I drew on the data and analyses from both the conceptual interview (data collection session 1) and the standardized patient encounter (data collection session 2). I compared each participant's characterization of practice (based on the analyses of his/her conceptual interview) with his/her clinical decisions during the standardized patient encounter (Dall'alba, 2002). Specifically I compared participants' overall characterizations of practice with their overall approaches to the patient examination and assessment based on their reasoning patterns, hypotheses, and their stated priorities and goals for the patient during the standardized patient encounter. I included case studies of five participants to demonstrate these relationships in more depth. Finally, I examined the relationship between students' characterizations of practice and their engagement in reflection during the patient encounter.

Analysis of Variations by Program

To address whether PT student reasoning varies across programs, I drew on the findings from analyses of both the conceptual interview (data collection session 1) and the standardized patient encounter (data collection session 2), and compared across participants. Students' individual interview responses and resume sorts demonstrated how the students perceived their learning.

Based on the students' conceptual interviews (data collection session 1), I analyzed for patterns of characterizations within each program, specifically identifying characteristics

highlighted by the majority of students in that program. I also examined the students' Q-sort rankings to identify patterns within each program of items the students ranked highest. I then compared the patterns across programs to identify similarities and differences in students' characterizations of practice across programs.

I analyzed the students' actions during the standardized patient encounters and post-encounter interview responses (from data collection session 2) for patterns of actions and reasoning strategies within each program. I specifically examined this data for examination measures conducted, justifications for examination/assessment decisions, assessments made, and interventions selected. Based on the patterns I identified within each program, I then compared across the two programs to identify similarities and differences in the students' clinical decision-making and reasoning between the two programs.

Finally, I drew on students' descriptions of experiences that had influenced their understandings of physical therapy practice based on the resume sort during data collection session 1 and factors they described as influencing their thought process during the patient encounter during data collection session 2. I used this information to provide preliminary insights into factors that influence students' clinical reasoning and characterizations of practice. Further, in-depth analysis of programmatic factors influencing students' reasoning is beyond the scope of this study.

Researcher Perspective

I bring a unique perspective to this research as a physical therapist, physical therapist educator, and educational researcher. My perspective is informed by a combination of frameworks from the literature in physical therapy clinical practice alongside my work in teaching and learning and teacher professional development. This combination enables me to

analyze physical therapy practice from the insider perspective, yet be informed by theories of teaching and learning. Affordances of my combination of experiences include my ability to conduct educational research in physical therapy drawing on the perspective of existing frameworks of physical therapy clinical practice. Further, my work as a physical therapist educator significantly contributes to the development of my research questions based on my observations within the classroom and program overall. My situation of my analyses within the existing frameworks of physical therapy practice, however, may limit my ability to analyze phenomena occurring outside of this frame.

Trustworthiness and Credibility

I have incorporated multiple measures in order to enhance the credibility, dependability and confirmability of the findings in this study. To ensure data saturation, I interviewed an additional six students (three at each program) following the initial data analysis (Marshall, 1996). Preliminary analysis of these additional interviews revealed themes consistent with the previous data. To enhance the credibility of the findings, I drew on established methods of data collection including the standardized patient encounter and the conceptual interview questions (Shenton, 2004). All stages of analysis, including the preliminary coding frames, were informed by the existing literature in the field (Mays & Pope, 1995). I incorporated reliability coding for the structural coding stage of analysis (Shenton, 2004). For reliability coding, I trained research assistants on the coding schemes described in the analyses for research questions one and two, and the assistants coded a subset of the data. To enhance the dependability of the findings, I included detailed descriptions of the data collection process and the development of the data analysis (Shenton, 2004). I also triangulated across data sources for each research question (Lincoln & Guba, 1985; Merriam, 2009; Patton, 2002) to reduce the risk of bias and enhance the

credibility of the findings. I also included direct quotations (low inference data) throughout the findings to enhance the trustworthiness. Finally, throughout the data collection and analysis process, I maintained an audit trail to trace the development of the findings (Miles & Huberman, 1994)

Chapter 4

Characterizations of Practice

Expert physical therapists practice from a patient-centered perspective, integrating the patients' values into their assessment and treatment, and emphasizing teaching and empowerment over fixing problems (Jensen et al., 2000). These expert clinicians not only demonstrate this patient-centered practice in action, they also hold well-developed perspectives on practice that parallel these actions (Jensen & Paschal, 2000). Prior studies have demonstrated that professionals in a variety of practices tend to practice in ways that are consistent with their characterizations of practice (Dall'alba, 2002; McMullen, 1999; V. Richardson, Anders, Tidwell, & Lloyd, 1991). Professional development should support students' growth towards more expansive orientations to practice (Dall'Alba & Sandberg, 1996, 2006), yet studies of medical students indicate that many do not change their conceptions of practice during their education (Dall'Alba, 2004). These diverse characterizations of practice have implications for the students' interactions with patients and ongoing professional development (Anderson & Funnell, 2005; Cabana et al., 1999; Daykin & Richardson, 2004)

A physical therapist's beliefs and orientations about practice influence how he/she actually draws on capacities for reflection, deductive reasoning, and patient interaction in practice (Smith et al., 2008b; Trede & Higgs, 2008). Expert practice in physical therapy is characterized by reasoning from a patient-centered collaborative stance, drawing on diverse knowledge sources, valuing the patient's beliefs and knowledge, and focusing on patient education and empowerment over clinician performance (Jensen et al., 1992; Resnik & Jensen, 2003). Prior studies have indicated that while students and novice clinicians may acknowledge the value of patient-centered care, they do not practice in that way (Christensen & Nordstrom,

2013). These findings prompt the question of whether novice physical therapists lack the skills to engage in patient-centered care or if they do not conceptualize practice in this way. This chapter examines the question: How do PT students characterize physical therapy practice?

Findings

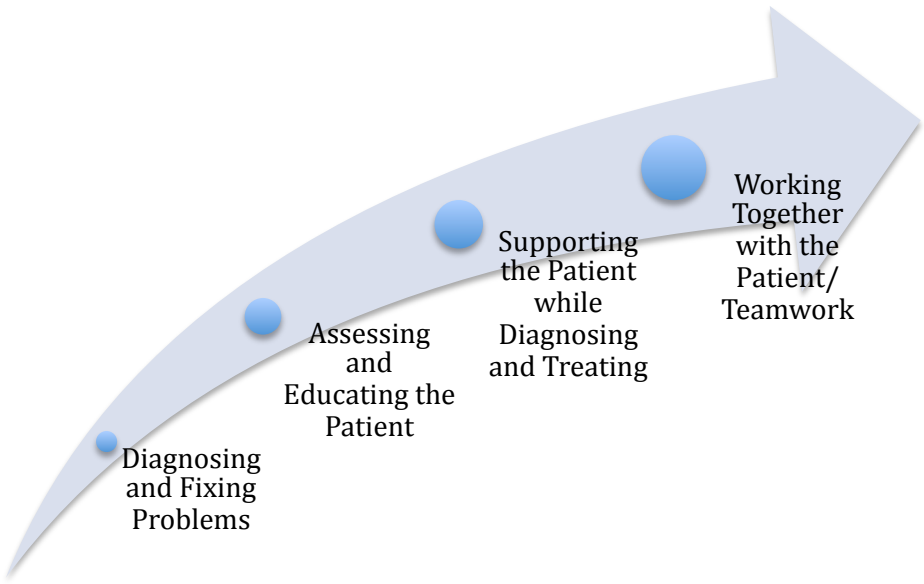
In this section I describe the students' characterizations of practice based on their interviews and Q-sorts. I first present the students' overall characterizations of practice based on the structural coding of the four domains informed by the current literature (purpose of the encounter, end goal of practice, knowledge valued, and patient's role) and the data from the Q-sort activity. I then present three detailed case studies illustrating the students' qualitatively different perspectives. Finally, I examine the nature of the experiences the students considered influential to their understanding of practice. I conclude this section with some considerations regarding the students' use of patient-centered language.

Overall Characterizations of Practice

The participants demonstrated four qualitatively different characterizations of physical therapy practice through their responses to the interview questions and their ranking of items in the Q-sort. I grouped the participants based on the category in each of the four coding domains (purpose of the encounter, end goal of practice, knowledge valued, and patient's role) that was most prevalent in their responses. The participants' characterizations ranged from a mechanical approach that involved diagnosing and fixing problems with an emphasis on patient compliance to a dynamic relationship between the PT and patient as illustrated in Figure 4.1. The students' Q-sort selections and descriptions further supported their characterizations of practice. In the following section, I describe the four perspectives evident in the students' interview descriptions

and then provide three detailed case studies illustrating the range of perspectives exhibited by the participants.

Figure 4.1: Trajectory of characterizations



Diagnosing and fixing problems. Three students described physical therapy practice with a focus on fixing problems. These participants characterized the purpose of the encounter as diagnosing and fixing problems and emphasized patient compliance in order to achieve an end goal of physical function. Each of these participants also indicated the importance of the PT's medical/professional knowledge in working with a patient. For example, Mason (from University A)'s description of the role of the patient indicated the importance of the PT's knowledge, the patient's responsibility to comply with the PT, and a focus on diagnosing and fixing physical problems.

> There is a lot of time spent at home that they need to work on, whether it is postural re-education, decreasing aggravating factors or changing the work environment, whatever it may be. That homework needs to be put in on their end. So that way we can get that patient as functionally independent as we can.

Kelly (from University A) described the role of the patient in similar terms. She also expected the patient to follow the PT's directions in order to address their problems.

> Well I expect them to at least try everything I mean I want them to be able to be responsive to what I'm telling them, you know be, try their, I mean if I correct them I want them to really try to do the correct thing, I mean unless they're really in pain I want them to listen to what I'm saying and try to like do, for example, exercises correctly.

Peter (from University B) furthered the emphasis on diagnosing and fixing problems through his metaphor for the work of a PT. In his description of the car mechanic, he highlighted the purpose of the encounter as fixing problems that rely on the PT's knowledge.

> Being a physical therapist is like… it's like being a car mechanic. Someone brings in their car, it's broken, and a physical therapist is expected to put it back together and fix it, so it's running like new, if not new, as good as you can get back, just repair it.

These three students' mechanical characterization of the work of a physical therapist is further highlighted by their rankings of the Q-sort items. Overall, these three students placed functional and activity testing in their most important list and all placed the patient's perspective and social support in their least important list. Their emphasis on functional and activity testing, however, was consistent with their characterization of physical therapy practice focused on diagnosing and fixing problems. The students who considered functional status or activity level testing most important indicated it was so because activity testing identified impairments and skills the PT needed to address in treatment. As Mason explained in his selection of assessment of functional status, "Starting with functional limitation I can get a sense, as a PT, as to what the impairments might be." Peter indicated activity testing was important as it led directly to treatment: "Just how well they are able to do these functional activities, those would be the things that I would try to work on first." Two of the three students describing physical therapy practice with a focus on diagnosing and fixing problems also placed tissue level testing as one of their most important items in the Q-sort. Their explanations indicated that the medical/tissue

level diagnosis was key to providing the appropriate treatment for the patient. As Kelly explained her reasoning for placing tissue-level testing in her most important list, "If you don't have a diagnosis… it's probably important to figure out what's wrong… you wanna know that (the diagnosis), get them 100% that figured out before you start treating." The students' primary focus on diagnosing and fixing problems parallels the practice of novice clinicians with a focus on the mechanics of problem solving (Jensen et al., 1990). This focus suggests that the students' limitations in practice may be a result not only of limited skill but also of an inability to envision the patient-centered approach to practice that is characteristic of experts.

All of these students placed the patient's expectations in their least important list in the Q-sort. Their justifications indicated that they believed they could make assumptions about the patient's expectations. For example, Mason explained,

> I know why the patient is there in PT… I can kinda use a little bit of logic and deducing why they are there. So spending a lot of time on what their expectations for PT are, I can kinda figure, these guys want to get back to where they were before or better.

These students also believed that the patient's expectations would not impact their ability to provide an effective treatment. Peter explained, "I think you know getting their goals is very important, but as for the expectations… I don't think that what their expectations are for therapy is as important, cause again you could still provide a good treatment without it." The low value these students placed on the patient's expectations for therapy suggests their limited understanding of the value of patient input for effective therapeutic outcomes (Arnetz, Almin, Bergstrom, Franzen, & Nilsson, 2004; M. D. Bishop et al., 2013; Fuentes et al., 2014; Holmstrom et al., 2003; Milidonis, Godges, & Jensen, 1999). The students' explanations for their low ranking of social support in the Q-sort were also consistent with their medical/mechanical characterization of practice. Kelly explained her low ranking of understanding the patient's

social support by explaining that it was more important to address the patient's injury. Peter further emphasized that the work he did with the patient in the clinic would not be impacted by the patient's level of social support. These students' over-emphasis on physical function isolated from the patient's psychosocial roles may limit their effectiveness in clinical practice and professional growth (Anderson & Funnell, 2005; Cabana et al., 1999; Daykin & Richardson, 2004).

Assessing and educating the patient. Two students (both from University B) emphasized the patient's role in learning with continued value on the PT's knowledge. While this characterization gave a more active role to the patient, these students continued to value the PT's medical knowledge over the patient's own knowledge. These two students consistently indicated that the purpose of the PT's encounter with the patient was to assess the patient and educate the patient regarding his/her condition and how to manage it. Lisa (from University B)'s description of a typical encounter with a patient in the clinic highlighted this role of assessing and educating the patient and expecting the patient to learn skills from the PT to carry out on his/her own.

> There were like three people who I saw like this and all of these people come in and they have this very stooped posture and forward head … they didn't come in for postural re-ed but from what we know about posture for the neck and for the shoulder and how the shoulder works, the big thing that I was treating was postural re-ed. So I was giving them very specific postural exercises to affect their neck positioning, their head positioning, and their shoulder positioning to work on their neck and shoulder pain.

Hannah (from University B) also emphasized the role of the PT in educating the patient as she described what she believed was most challenging in physical therapy practice. She continued to value the PT's knowledge in the interaction as she highlighted why the PT needed to conduct extensive education for some patients.

> It's hard because from a clinical standpoint you know what you want to address and you know that it's depending on what it is, it's going to take more than one treatment session and it's going to take a little bit of patience and also not everybody has the background knowledge to understand what a joint mobilization is why you're stretching them and all the uncomfortable things versus the soft tissue and the massages and all that. And I think it's just hard to balance out between telling them, 'Okay well this is what's causing your problem…' Kind of negotiating, because you want the compliance but you don't want to bombard them with everything clinical because they might not understand.

Like the three students described above, these two students also placed high value on assessing the patient's functional status in their Q-sort rankings. Their explanations for their rankings, however, indicated that this information served a different purpose for them. They ranked assessing the patient's functional status highly because they believed it gave them information regarding how the patient's life activities were impacting his/her injury and functional abilities, and that it also gave them insight into what the patient would want to accomplish in PT. Hannah explained:

> I think that gives you a lot of insight into things that they are doing in their day that maybe hurting or helping them. It also gives you an idea of what is important them and how invested they will be… just gives you an overall idea of what their goals are and what's important to them.

They indicated that this information was important for setting goals in physical therapy. Both of these students also ranked the patient's expectations for therapy amongst the most important items in the Q-sort. Their explanation was consistent with their characterization of practice focused on education. They indicated that the patient's expectations were important because they impacted how the PT needed to interact with the patient to increase his/her participation in therapy. They also indicated that the patient's expectations would give them insight into how they needed to educate the patient regarding his/her responsibilities in therapy. Lisa explained,

> I think learning about the patient's expectations for PT is very important, and this goes back to that idea, are they expecting to come in and have me work on them for half an

> hour and then go home and be better, or are they expecting to have a home program and actively participate in exercises in the clinic and are curious what they can do to prevent and get back and all that kind of stuff.

These students' emphasis on teaching in their characterizations of practice suggests their understanding of one characteristic evident in the work of expert physical therapists: the value of teaching over hands on treatment (Jensen et al., 1992).

Supporting the patient while diagnosing and treating. One student (from University A) described the purpose of the encounter between the PT and the patient as supporting the patient while carrying out the diagnosis and treatment. In addition to her emphasis on supporting the patient psychologically, her responses indicated that she expected the patient to learn from the physical therapist. As she described her expectations for the patient, she indicated that she wanted the patient to try new activities, but she also reflected a role for the PT in supporting the patient while he/she tries.

> So hopefully they would have an open mind to trying new things and trying things that may be uncomfortable or things like that. That's what I really enjoy about my patient in clinic is she's always willing to do one more and if I say hey do you wanna try this, have you done this since your incident, and she's like no, but yes I wanna try it, she's always like sure I'll try it, and I'm like if it doesn't work then we know, but at least we can try. (Chloe)

She also described the importance of understanding the patient's psychological state and providing appropriate support to encourage his/her participation in therapy. She acknowledged the challenges for the PT in creating this motivating and supportive environment for the patient.

> Probably the psychological part of it is really hard, like if you have a really depressed patient or they don't wanna do it, noncompliance, I think that's really difficult just because you have to pump up your inner cheerleader and get them invested in what you're saying and what you're doing, and I think that persuasive part is more difficult when you have somebody that is not receptive to it. (Chloe)

Chloe's rankings of the Q-sort items also indicated her focus on the patient's psychological needs alongside her need to address physical function. She described the

importance of understanding the patient's psychological state as it impacted the patient's level of participation in therapy. She also placed learning about the patient's employment and leisure activities in her most important list in the Q-sort as she indicated the patient's activities impacted the way she set goals. Chloe's attention to the patient's emotional state as a crucial element of therapeutic interactions suggests she is developing a perspective consistent with a biopsychosocial model of care, in which the patient's emotional and life experience are important aspects of healthcare (Jones et al., 2008; World Health Organization, 2002).

Working together with the patient. Finally, two students (one from each program) described physical therapy practice in terms of working together with the patient. These students indicated the importance of the patient's own knowledge and input as they impacted the therapy process. They indicated that they expected the patient to learn during the therapy process, but their description of this learning indicated a greater role for the patient in gaining an ongoing understanding of his/her condition compared with the other students' focus on the patient learning specific skills to carry out. These two students also indicated participation in life activities and quality of life as important end goals for physical therapy, beyond the level of physical functioning. Bethany (from University A) specifically emphasized the importance of teamwork with the patient and other healthcare providers throughout her descriptions. Her metaphor summarized her clinical examples as she described the work of a physical therapist as a bridge.

> So PT as a profession connects patient to patient. So you have group exercises, so you can connect patient to patient. And you can connect patients with their family through like education. And also how to incorporate the disability into their lives or the patient's life. And then I guess a bridge to other health care professionals. As in referral.

Bethany's Q-sort was consistent with her characterization of physical therapy practice focused on teamwork with the goal of enhancing the patient's quality of life. She explained her high ranking of understanding the patient's level of social support:

> Obviously if you are talking about a toddler or just a kid, if they don't have family support… Also, school stuff, if they are being teased at school, or if they are being, not bullied, but just not looked at the same like other kids, and I think that is very important in a kids perspective.

Bethany and Sophia (from University B) both gave a high ranking to activity level testing, which they indicated was important because it impacted the patient's participation in life activities. Sophia also highlighted a return to life activities as the ideal end goal of physical therapy practice. Her description of the ideal outcome of a PT's encounter with a patient indicated the importance of the PT working together with the patient to determine outcomes and the role of the patient in learning and understanding about his/her condition and how to self-manage so he/she can return to activities.

> So 100% pain free was not really realistic, but learning how to move better, learning so that the patient knows how to manage their symptoms, the patient knows their limits and what they shouldn't be doing, that they're actively trying to break their bad habits and when they, I always say that they're graduating from PT and so these are your exercises and I try to teach them where to go from there, so that they kind of understand why they're doing their exercises, what the benefit of it is to them.

Sophia indicated understanding the patient's perspective was one of the most important items in the Q-sort. She explained that she believed it was important to understand where the patient was coming from and what he/she valued in order to drive the patient's participation in therapy. These two students' characterizations of practice emphasizing working with the patient parallel the actions of experienced clinicians who practice from a biopsychosocial perspective, focusing their work on enhancing the patient's quality of life and participation in meaningful life activities (Jensen et al., 2000; Jones et al., 2008).

Relationship of Participants' Characterizations Across Domains and Responses

Consistency across interview questions. Participants demonstrated consistency across their responses to the questions. Overall coding for each participant only varied by one category within each domain. For example, four participants had some responses that indicated the patient's role was *learn and do* and some with *learn and understand*. No participant demonstrated divergence in any of the categories. For example, no participant indicated the purpose of the encounter as highly mechanical such as *diagnosing/fixing a problem* in one response and highly interactive such as *teamwork* in another.

Relation of explicit and tacit theories. Overall students demonstrated consistency between their explicitly stated purpose of physical therapy (interview question 1) and the purpose that was evident in their descriptions of concrete patient examples and their metaphors for practice. For example, Lisa explicitly described the purpose of PT in terms of finding efficient movement patterns and focused on the role of PT in physical function. In each of her concrete descriptions of patient examples, she consistently characterized the desired outcome of physical therapy in terms of physical function and movement education (*learn and do* and *learn and understand*). Bethany strongly emphasized the psychosocial and physical well being of the patient in her explanation of the purpose of PT, and her concrete patient descriptions consistently indicated the importance of *teamwork* in the patient encounter and *quality of life* as an important outcome of physical therapy practice.

The participants demonstrated similar patterns of consistency between their explicitly stated role for the patient (interview question 8) and the role of the patient they implied through their concrete examples and metaphors. For example, in his explanation of the role for the patient, Mason explained that the patient needed to complete the exercises the PT prescribed and

could not expect only passive massage treatments. Throughout his concrete examples, Mason also indicated a compliance role for the patient.

Case Studies

The following case studies provide more detailed descriptions of three students' characterizations of practice that span the spectrum of perspectives described above. These three students' characterizations ranged from fixing mechanical problems to education to providing the patient with support and connections.

The mechanic (Mason from University A). Throughout his descriptions of physical therapy patient encounters and his expectations for the patient, Mason described a mechanical perspective on physical therapy practice. This characterization emphasized making the appropriate diagnosis and selecting treatment. Each of his descriptions focused on the importance of the physical therapist's knowledge and skills. Mason's description of a typical physical therapy encounter focuses on the technical aspects of diagnosis and treatment.

> I feel like the PT should take their time with the initial eval to make sure that their differential diagnosis skills are correct… And that first treatment should really be focused on that, the examination and a basic treatment and from the second visit on.

Mason's emphasis on technical differential diagnosis permeates all of his descriptions. He identified the work of a car mechanic as his metaphor for the work of a physical therapist. He described how the PT's work was like that of a mechanics.

> So there's a clunk in the car. First thing, as a mechanic, what I would tell the patient is… I need to see what could be causing the clunk and then kind of start with… Now let me go through my list and run these diagnostic tests…. Like a mechanic, you are going to systematically have to break down what could be causing the issue and then what am I going to do to fix it.

Each of Mason's responses indicated his characterization of physical therapy practice as a treatment of mechanical problems wherein the patient needed to comply with the therapist's plan

of care. Mason's characterizations indicate a view of physical therapy that parallels the practice of many novice practitioners: focused on the mechanics of following procedures and treating medical problems (Jensen et al., 1992; Jensen et al., 1990). Although this characterization may be typical of novice practice, the value the student placed on this approach to practice may limit his development of skills for more holistic practice (Dall'Alba & Sandberg, 2006).

The Movement Educator (Lisa from University B). Throughout her interview responses, Lisa described physical therapy practice as a process of teaching patients how to move efficiently. Her explicit description of the purpose of physical therapy focused on movement and efficiency.

> I think PT is all about finding the most efficient and pain free way for people to move, so it's all about moving around in your day, humans are meant to move and how can we make their, a person's movement efficient, so that they're not wasting a lot of energy.

Building on her view of movement, Lisa described her ideal outcome in physical therapy as the patient learning to self-manage his/her condition. The learning she described goes beyond replicating what the therapist instructed and entailed the patient gaining greater insight into his/her condition and movement patterns.

> So orthopedic practice, my ideal outcome would be to give the patient tools to note when they're going into a painful cycle or when they're falling into old habits, so they could correct for it and treat whatever their symptoms are at that point in time.

When asked what she meant by "tools," Lisa explained, "Education, patient education." Lisa's perspective of the physical therapist as an educator and facilitator extended to her metaphor where she explained that physical therapists were like a dam that shifts the flow of the river, but allows the river to determine its course. She explained that PTs don't heal, that they facilitate healing.

> It takes out the magical aspect out of it and … it feeds back into patient education and giving the patient the ability to take care of themselves. If we approach therapy as, I am

> the healer you have to come to me; it takes away the self-efficacy of the patient. Whereas if we are facilitating healing and part of the facilitation is by teaching them how to move properly… We're facilitating their healing process. We're giving them the tools to heal themselves.

Lisa's theme of PT as educator pervaded all of her responses. She consistently focused on the importance of the patient's movement patterns and the PT's role in educating the patient to become more aware of his/her own movement patterns. Lisa's characterization of practice focused on movement education demonstrates her integration of two key elements of physical therapy clinical practice, including the focus on movement and patient education for self-management (Jones, 1992; S. May et al., 2008; Milidonis et al., 1999; Rothstein et al., 2003). She, however, placed limited focus on patients' psychosocial experiences of their conditions, suggesting limitations in her development of a truly patient-centered perspective on practice (Jones et al., 2008; Mead & Bower, 2000)

The Bridge (Bethany from University A). Bethany's interview responses consistently indicated physical therapy should enhance the patient's quality of life, even if physical function could not be improved. She described the physical therapist as playing a role in connecting patients to other people (other patients and family) and meaningful life activities. Bethany indicated a greater role for the physical therapist in addressing the patient's psychological and emotional needs than any of the other participants did. This characterization of a psychosocial role for physical therapy pervaded all of her interview responses, beginning with her explicit description of the purpose of physical therapy.

> So it's not just the physical part. I guess also the mental part… Say people with chronic pain syndrome, they don't just have physical pain; they also have this perception that they're always in pain; it's not just the physical part. So you have to deal with patients' psychosocial aspect of it and also family. You have to educate the family and the patient and the caregiver… It's also about treating them as a whole.

Bethany's emphasis on addressing the whole person and building connections permeated all of her responses. Her concrete patient examples exemplified her perspective on physical therapy as a team activity. Continuing with the theme of connections, Bethany gave an example of a bridge as a metaphor for the work of a physical therapist. She explained,

> I guess it could be a bridge. So PT as a profession connects patient to patient... And you can connect patients with their family through like education. And also how to incorporate the disability into their lives or the patient's life. And then I guess a bridge to other health care professionals. As in referral.

Bethany's relational characterization of physical therapy practice is also exemplified in her explanation of the responsibilities of the patient. She expresses that the PT and patient must build mutual trust and that the improvement patients experience from physical therapy interventions may be psychological instead of physical.

> But if there is no change (in physical ability), then I think, by changing something there can be change. That something can be mentality, mood, just seeing the pathology in a different way. … Then they have to trust us. Respect which is fair, they respect me, I respect them.

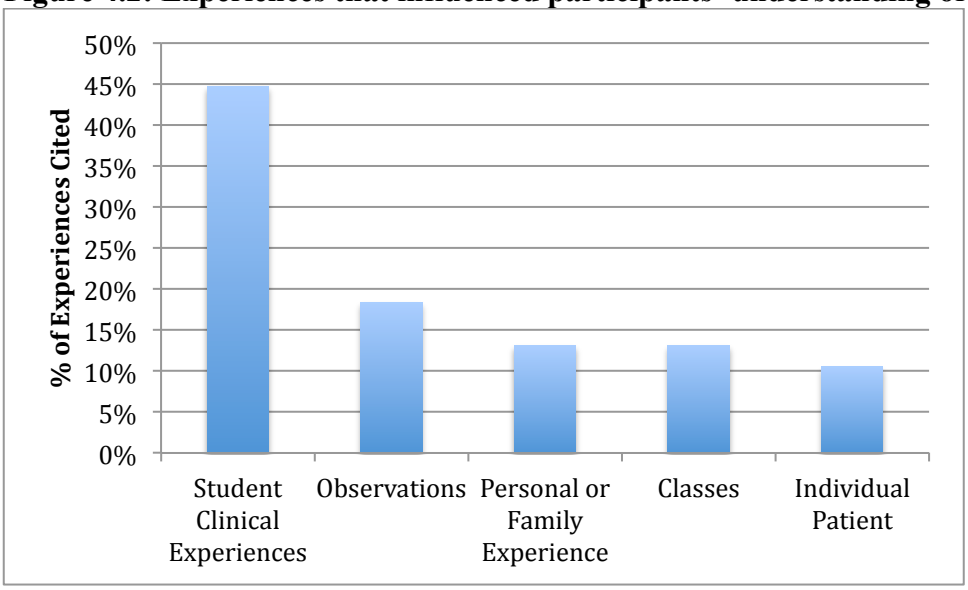
Bethany's responses to all of the interview questions indicated her view that physical therapy should address the patient's psychosocial needs in addition to his/her physical needs. Her descriptions suggest that teamwork between the PT and patient and others in the treatment team is necessary to achieve these outcomes. Bethany's emphasis on teamwork suggests her development of critical elements of patient-centered practice, including placing value on the patient's interests and emotional experiences (Mead & Bower, 2000). Further, her emphasis on mutual respect between patient and practitioner suggests development of an approach to practice that reduces the power difference between the two parties that may support greater patient empowerment (Engel, 1981; Holmstrom & Roing, 2010; Taylor, 2009)

The three students' perspectives described above represent characterizations of practice on a continuum from typical novice, practitioner-centered practice, to typical physical therapy practice focused on movement, to a biopsychosocial perspective with an emphasis on the patient's psychosocial needs (Jensen et al., 2000; Jensen et al., 1992; Mead & Bower, 2000). The range of student perspectives from fixing problems to educating and learning from patients parallels the process of professional development noted in novice physical therapists over their first two years of practice (Hayward et al., 2013). Each student provided examples that consistently indicated his/her perspective, suggesting that these students have well founded perspectives on the practice of physical therapy (Jensen & Paschal, 2000). The existence of these three distinct perspectives within a group of students at the same stage of their education suggests that factors other than simply time in practice impact students' (and later clinicians') perspectives and approaches to practice. These students' perspectives have implications for their desired outcomes and approach to patient interactions and treatment (Dall'alba, 2002).

Factors Influencing Students' Perspectives on Practice

Experiences cited by the students. Students described a wide variety of personal and professional experiences that influenced their views on physical therapy practice. Specifically, students described clinical experiences through their educational programs, clinical observations prior to their physical therapist education, classes within their programs, and personal experiences. Students with more clinical experience (those from University B) cited clinical affiliations. Two students cited specific patient interactions during those affiliations, while students with less clinical experience (those from University A) cited clinical observations and personal experience. Figure 4.2 summarizes these experiences.

Figure 4.2: Experiences that influenced participants' understanding of practice



These experiences influenced students' perspectives on the purpose of physical therapy as well as their own identities as novice physical therapists. Some students focused primarily on experiences that influenced their technical understanding of the profession (types of procedures used) while others indicated greater impacts on their understanding of the importance of working with other people (patients and colleagues). Further, students identified experiences that built their confidence in seeing themselves as PTs.

The students' explanations for how each experience impacted their perspectives point to the different ways that students' exposures to physical therapy practice impact their learning and perspectives. Table 4.1 summarizes the ways that students indicated that their experiences influenced their perspectives.

Table 4.1: Co-occurrences of influence codes

		Type of Experience					
		Classes	Student Clinical Experiences	Individual Patient	Observations (volunteer/ aide)	Personal or Family Experience	Total
Perceived Impact of Experience	Breadth of PT Practice	2	1	1			4
	Developing Own Confidence as PT		6			1	7
	Figuring out how to work with people		5	4	1	2	12
	How PT changes lives		1		3		4
	PT is about Procedures		4		2	2	8
	PT is complex	3	1		2		6
	PT requires creativity				1	1	2
	What not to do		1		2		3
	Working with obstacles		2				2
	Total	5	21	5	11	6	

Students cited their clinical affiliations and specific patients they encountered during those affiliations as impacting their ideas of how PTs have to work with people (and the challenges of working with individuals). Only students from University B cited individual patients, while students from both programs cited clinical experiences overall. Clinical experiences and observations also impacted students' perceptions of the procedures PTs conduct. Students primarily developed their identities as PTs through their clinical experiences. Students cited their coursework for imparting the complexities of the work of a physical therapist. These findings suggest that students perceive many experiences as influencing their perspectives, yet these experiences impact different aspects of their perspectives.

Language Use: Patient-Centered Language

Three students' use and interpretation of patient-centered language emerged as an unexpected finding during the interviews. The literature identifies five key elements in patient-

centered practice, including the following: 1) addressing the psychological and social impacts of disease, 2) understanding the patient as a whole person, 3) valuing the patient's knowledge in decision making, 4) placing priority on the therapeutic relationship over "fixing" problems, and 5) acknowledging that the health care practitioner and patient influence each other (Atkins & Ersser, 2008; Mead & Bower, 2000). These students used the terms patient-centered, active participant, and autonomy in many of their responses. When pushed for concrete examples of what they meant in their use of these terms, the students provided examples that suggested that they did not fully understand the use of these terms. The following section describes several examples of students' use and interpretations of patient centered language.

Students discussed active participation, autonomy, and communication in ways that diverged from the patient-centered literature. For example, Mason (from University A) explained that the patient should be an active participant in the therapy process. When asked for an example of this, he explained the need for patients to follow through on home programs.

> Patient plays a bigger role than they think that they should play… There is a lot of time spent at home that they need to work on, whether it is postural re-education, decreasing aggravating factors or changing the work environment, whatever it may be. That homework needs to be put in on their end. So that way we can get that patient as functionally independent as we can.

At no time did he indicate a constructive role for the patient in the development of the therapy plan. Peter (from University B) explained that the patient should have autonomy in coming up with treatments and goals. He went on to explain that autonomy meant that these goals should be designed around the patient's activities.

> Well when they come in you say, you know try to find the things that they like to do or like to get back to and so you would try to tailor your treatment around their goals, so if they're a runner, you would include running in their rehab, you wouldn't include swimming or biking and just ask them.

He continued, however, "I don't think that knowing what their expectations are for therapy is as important, cause again you could still provide a good treatment without it." This response suggests only a partial understanding of patient-centered care, in that he places importance on matching the goals to the patient's functional needs but does not consider the patient's perspective an important aspect of this process. Similarly, Hannah (from University B) expressed the importance of patient communication, yet described a rather limited view of what this communication should encompass: "so I feel like the patient's role is to really try to communicate what it is that's bothering them and they're the reason we're there." Each of these participants' interpretations of patient-centered language suggests a more limited role for the patient than the patient-centered literature promotes (Lewin et al., 2001; Mead & Bower, 2000; Stewart, 2001). For example, these students' emphasis on the patient's need to follow the physical therapist's treatment plan limits the patient's input in the therapy process and maintains the power differential between patient and practitioner. With this use of patient-centered language, students may think that they are engaging in patient-centered practice when their actual practice is more technical and practitioner-centered.

Discussion

This chapter has described students' conceptualizations of physical therapy practice. In the following, section I discuss three findings from this chapter that have implications for clinical education. First, students described a broad range of conceptualizations that parallel different stages of professional development. Second, the students' perceptions of the impact of clinical experiences on their perspectives indicate implications for clinical education. Third, the students' use of patient-centered language points to possible limitations in their understandings of patient-

centered practice. Finally, I describe the implications for clinical education based on these findings.

Range of conceptualizations

Students' responses indicated conceptualizations ranging from highly mechanical to very interactive/psychosocial. Most students described examples wherein the purpose of an encounter with a patient was to make a diagnosis and initiate treatment as well as educate the patient. They primarily valued their own medical knowledge and expected the patient to learn what they taught. Overall, the students conceptualized the purpose of physical therapy practice as restoring the patient's physical, functional abilities. The majority of students (five out of eight) also placed limited importance on the patient's expectations for physical therapy as an influence on their treatment plans. Three students, however, described conceptualizations that placed a greater emphasis on supporting the patient and educating the patient. Two students expressed a role for the PT in providing emotional support and advocacy for the patient. These findings parallel prior findings in physical therapist, medical, and dental students wherein the students expressed conceptualizations ranging from purely biomedical to integrated medical and psychosocial (Dall'alba, 1998, 2002, 2004; Hendrick et al., 2009; Lindquist et al., 2006).

The students' characterizations of practice range from that of a typical novice physical therapist to views that approach those of more experienced clinicians. The most common conceptualization (PT centered, addressing mechanical problems) parallels the novice approach to clinical practice described in the literature (Jensen et al., 1992). The limited value the majority of students placed on understanding the patient's expectations of therapy suggests they have significant progress to make towards the conceptualization of practice held by expert practitioners, wherein understanding the patient's context and experience are crucial to reasoning

(Christensen et al., 2013). No student described a truly patient-centered, constructive perspective as might be found in an expert (Resnik & Jensen, 2003). The students' range of conceptualizations suggests the possibility for progress along the continuum from novice towards expert, though full expert conceptualization may not be achievable at this early stage. Further, as prior studies have indicated, a breadth of experiences may contribute to novice practitioners' ability to function at a higher level (Wainwright et al., 2011).

Factors Students Identify as Impacting their Conceptualizations

The full range of conceptualizations was evident in students from both academic programs, suggesting that factors outside of the educational program play a role in influencing students' perspectives. The influences cited by the students support this hypothesis as the students cited clinical experiences and observations most frequently as impacting their understanding of practice. Academic programs, however, may be able to strategically implement clinical experiences to best support students' development of holistic perspectives on practice.

Clinical experiences may impact students' perspectives in both expansive and limiting ways. The two students (from University B) who cited individual patient interactions in their descriptions of influences were also the ones who described the greatest amount of teaching/learning in their conceptualizations of practice. This relationship raises a question as to whether these students were able to learn from these individual patients because they already had a more sophisticated conceptualization or if their attention to the patient supported their development. Their ability to learn from individual patients may be indicative of a more reflective approach to professional learning, which may be individually driven or may have been supported by their clinical environments (Mostrom & Black, 2013). On the other hand, the student (from University A) who gave the most mechanical conceptualization of practice cited

clinical experiences and observations in terms of procedures used as well as examples of what he perceived as non-optimal practice. The diverse ways in which students perceive their clinical experiences as influencing their perspectives suggest that it is not the clinical experiences alone, but how they are implemented that impacts students.

Understanding of Patient-Centered Care

The responses expressed by some students suggest limitations in their understanding of patient-centered care. For purposes of this study, I did not specifically ask any questions about patient-centered care but allowed students to freely describe their views on ideal and typical practice. The literature on patient-centered practice emphasizes the importance of the patient as a constructive, active participant in his/her care, the practitioner's respect for the patient's knowledge and perspective, and the value of the patient-practitioner relationship itself (Atkins & Ersser, 2008; Mead & Bower, 2000). The students' use of language in their responses indicates that they all have exposure to and experience with patient-centered language, yet they hold different understandings of what that language means in action. Specifically, these students' use of active participation to describe compliance with home exercises suggests they give minimal value to the patient's knowledge in driving care. This attitude could limit the students' effectiveness in practice as the practice of patient-centered care and shared decision-making requires health care providers to have attitudes and beliefs that value the patient's knowledge and input in the process (Bernabeo & Holmboe, 2013). These students' misapplications of patient-centered language may also indicate their attempts at applying newly learned concepts to previously developed practitioner-centered views of practice. This mismatch of terminology and interpretation for practice parallels findings in teacher professional development, wherein teachers may adopt the language of new policies or practices to explain their existing practices

(Cohen & Ball, 1990). For physical therapist educators, these findings indicate the importance of asking students to provide concrete examples as they may use language in ways that vary from the established use. Further, physical therapist educational programs should provide experiences that challenge students' understandings of patient-centered practice. Direct patient experiences both within the academic program and through clinical education may support students in developing a more comprehensive understanding of patient-centered practice.

Implications for Physical Therapist Education

Clinical education. The findings in this chapter suggest the importance of appropriate selection and placement for students in clinical affiliations. Clinical experiences are shaping students' perspectives in addition to supporting their skill development. Effective clinical instructors integrate practices that support reflective learning (Kelly, 2007); however, studies suggest that most clinical instructors do not use time for reflection during clinical experiences (Page & Ross, 2004).

Clinical instructors' teaching practices may impact how students develop their conceptualizations of practice. Clinical instructors could guide students in analyzing video of their clinical practice to support them in becoming more reflective on their own practice and shifting their perspectives on practice (Holmstrom & Rosenqvist, 2001; van Es & Sherin, 2010). Instructors supporting students in reflective practice, however, need to highlight elements of practice the student may not attend to naturally, as the student's pre-existing orientation to practice will influence what he/she typically attends to (Larsson, Holmstrom, Lindberg, & Rosenqvist, 2004). This reflective practice can promote a shift in practitioners' perspectives, especially when they are confronted with aspects of practice outside of their typical assumptions. Further, guiding students or practitioners to question the effectiveness of typically selected

patterns of interaction and their attributions for success or failure may support shifts in orientation to patient-centered practice (Anderson & Funnell, 2005). The potential for critical reflective practice to enhance practitioners' orientations to practice suggests that activities designed to support reflection on and analysis of practice may be vital for effective professional development within entry-level physical therapist education and beyond.

Classroom education. While clinical experiences exert a strong influence on students' understandings of practice, didactic classroom experiences can also impact these understandings. The didactic curriculum should support students' growth towards more expansive orientations to practice (Dall'Alba & Sandberg, 1996, 2006), yet studies of medical students indicate that many do not change their conceptions of practice during their education (Dall'Alba, 2004). Two factors within the classroom level of physical therapist education may impact students developing perspectives on practice: 1) content overload, 2) the examples of practice presented in classes.

One critical element for physical therapist education relates to content overload. In a profession in which students must develop a sufficient foundation of content knowledge, program directors need to consider how to effectively distribute coursework, as student perceptions of work overload influence their approaches to learning, primarily driving students towards a rote memorization approach to learning that is not compatible with effective clinical reasoning (Newble & Entwistle, 1986; Sadlo & Richardson, 2003). Placing a higher focus on clinical reasoning and communicating about reasoning may help reduce the implicit impact of emphasis on factual knowledge and technical skills and can promote students' development of values consistent with patient-centered reasoning (Ajjawi & Higgs, 2008a).

The clinical examples and the opportunities for skill development that faculty present during university coursework can impact students' understandings of practice. The

representations of practice (the examples of practice enacted within the educational program) influence what students learn to see from the disciplinary perspective (Grossman et al., 2009). Programs that emphasize students' technical skills and scientific knowledge over individual patient needs may sway students away from a patient-centered perspective (Kieser, Dall'alba, & Livingstone, 2009; Shepard & Jensen, 2002). Using an explicit model of practice may also help faculty offer representations of practice that better align with the overall mission (Santasier & Plack, 2007). The inclusion of patient examples and case studies that provide the students with a broader view of the patient's life (not only the clinical details of his/her injury) can support students in developing more contextually situated approaches to interventions (Neistadt, Wight, & Mulligan, 1998). The models of practice students are exposed to during their didactic coursework can set the stage for how they approach patient care during their clinical affiliations.

Conclusion

Students hold a range of conceptualizations of the purpose and enactment of physical therapy practice. In this chapter all of the participants were at the same stage of their education, yet they expressed a range of views on practice from a mechanical and practitioner centered view to a more holistic and patient-centered view. The students' identification of clinical experiences and observations as the primary influences on their perspectives suggests a strong role for clinical education in supporting students' development of more patient-centered characterizations of practice. The current structure of clinical education within most entry-level physical therapist educational programs, however, presents challenges to effectively supporting students' developing perspectives due to the variety of facilities and clinical instructors involved in the process.

Although this chapter did not directly relate the students' characterizations to their actual clinical practice, the literature indicates that the range of conceptualizations described by the students here indicates their propensity towards qualitatively different approaches to patient encounters (Dall'alba, 2002; McMullen, 1999; V. Richardson et al., 1991). The following two chapters will explore this relationship between students' conceptualizations and their enacted practice in more depth. In chapter five I describe the students' approaches to the patient-encounter to identify the varieties of ways that students engage in clinical decision-making. Chapter six builds on chapters four and five to examine the relationship between the students' characterizations of practice and their clinical reasoning and decision-making.

Chapter 5

Clinical Reasoning and Decisions

Entry-level physical therapist education aims to prepare students to be autonomous practitioners. Clinical reasoning abilities reflect how students transfer knowledge acquired in the classroom to clinical patient care (Barrows & Feltovich, 1987). Further, clinical reasoning in physical therapy entails a complex interweaving of deductive reasoning with narrative understanding of the patient's perspective (Edwards & Jones, 2007). No prior studies, however, have examined how PT students engage the four capacities of content specific analytic reasoning, interactions with the patient, decision making under uncertainty, and patient-centeredness during their interactions with patients.

Findings

In this section I first describe the clinical actions (examination processes) undertaken by the participants, followed by their reasoning processes underlying those actions. I further describe the relationship of the participants' reasoning processes to their selected interventions for the patient and the errors present in their reasoning and decision-making. Finally I present evidence of the participants' use of reflection in- and on-action during their work with the standardized patient.

Examination Process

During the encounter with the patient, all participants began with a clinical interview and proceeded to conduct examination tests and measures. During the interview, all participants sought information about the patient's description of her chief complaint, the patient's goals for therapy, and the details of the patient's pain, including aggravating and easing factors, pain ratings and pain location. Most, but not all (6 out of 8) participants from both programs elicited

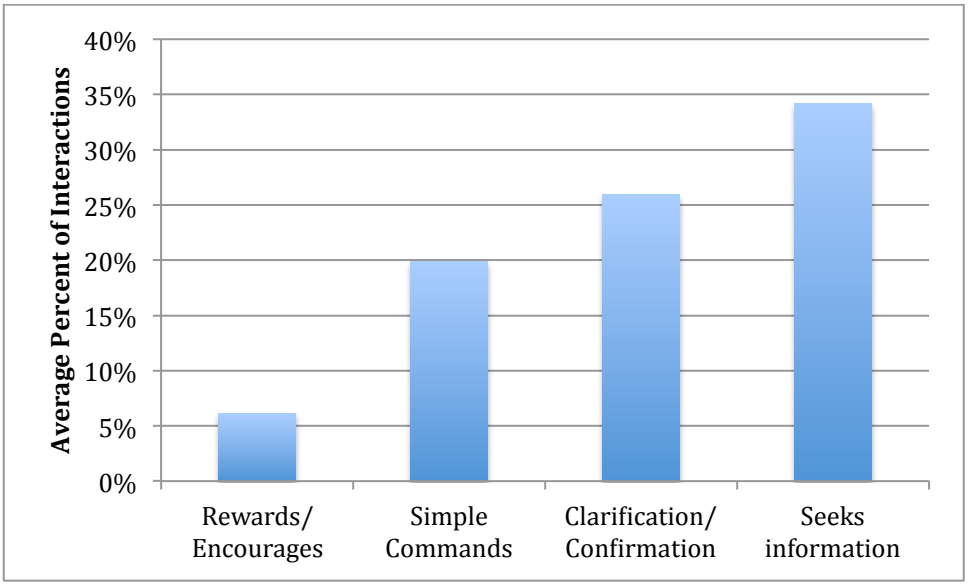
information about the patient's employment and recreational interests, and past and current medical history. The participants who inquired about medical history gained information about the patient's diagnosis of Type II Diabetes. Two students (from University A) did not conduct any follow up questions regarding the patient's diabetes and only one student (from University B) asked extensive questions about the patient's management of her diabetes. None of the students asked the patient about her expectations for the physical therapy process, thus missing an important source of information that can impact the effectiveness of interventions (M. D. Bishop et al., 2013; Daykin & Richardson, 2004; Puentedura et al., 2012).

During the examination, all students included tests and measures aimed at identifying the patient's pathology and biomechanical or structural links to the pathology. These tests included assessing posture and active range of motion (AROM) of the spine, palpating the painful region, and conducting special tests aimed at identifying affected tissues. Participants, however, demonstrated differing responses to the tests they conducted. For example, all participants observed the patient perform forward spinal flexion, three participants used this test to gather data on the quantity of movement and onset of pain, two participants used the test to hypothesize about factors that limit the patient's movement, two participants hypothesized about structures that may have been affected, and one participant hypothesized about the patient's willingness to move. Six of the eight participants conducted special tests for sacroiliac joint dysfunction (the pathology the case was designed around). Only half (4 of 8) of the participants assessed the patient's functional movement relevant to her complaint (gait and/or picking up objects from the floor).

Interactions with the Patient

Participants' interactions with the patient focused on gathering data and directing the patient during tests and measures. The most common patterns of interactions were seeks information (average of 34% of interactions), clarification/confirmation (26% of interactions), and simple commands (20% of interactions). On average, 6% of interactions involved the participant rewarding or encouraging the participant; however, this was not even across participants, with one participant giving no encouragement and one participant for whom 15% of her interactions consisted of rewarding or encouraging the patient. Figure 5.1 demonstrates the patterns of interactions.

Figure 5.1: Patterns of interactions

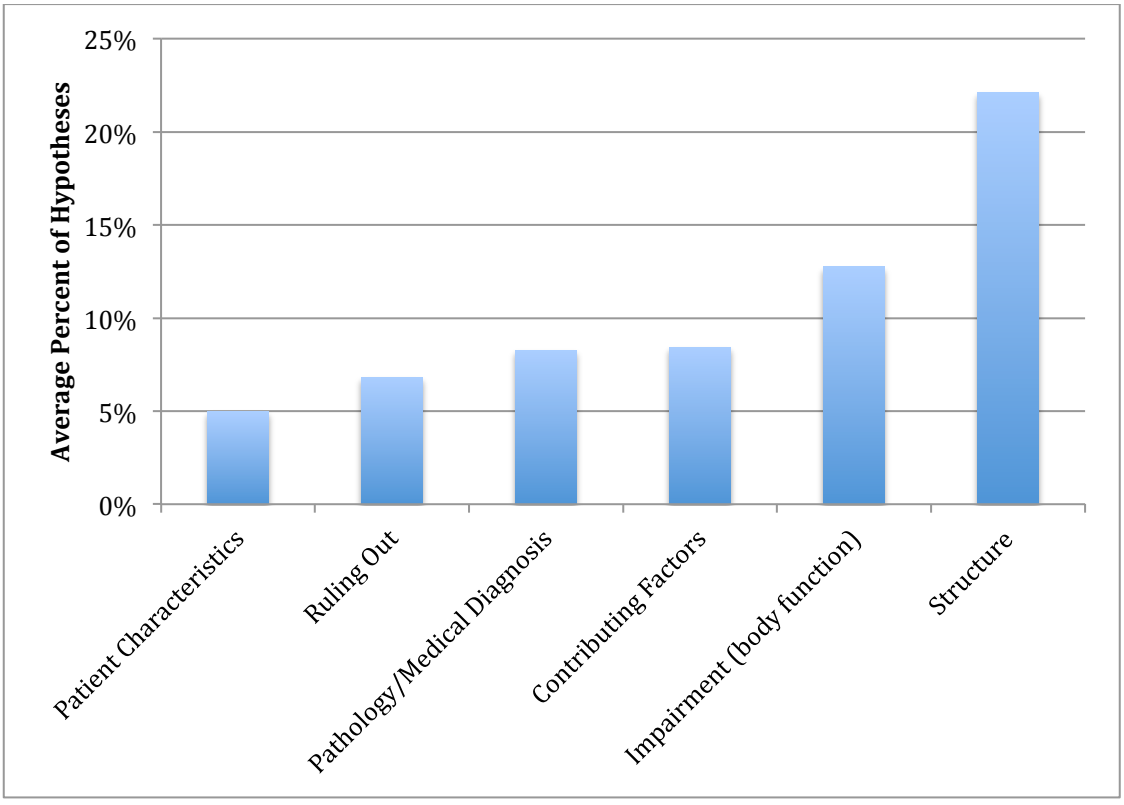


Hypotheses

The hypotheses the participants formed focused primarily on identifying the patient's affected body structure. Figure 5.2 displays the hypotheses the participants named most frequently. Appendix I: Table 1 provides examples of these hypotheses. This pattern of

hypothesis generation, including identifying the movement impairments that contribute to and result from the injury, follows closely from the patterns identified in the literature on physical therapy diagnosis, (Delitto & Snyder-Mackler, 1995; Guccione, 1991; Sahrmann, 1988). Three students demonstrated a pattern of generating hypotheses focused on understanding the patient's behavioral characteristics in addition to identifying the pathology. This pattern was unique to these students (from University B) and not present universally in the participants. Participants, however, rarely discussed the impact of the pathology on the patient's life (participation) or the patient's perspective on her condition.

Figure 5.2: Most common hypotheses generated by participants



The hypothesis code co-occurrences further illustrate the elements of physical therapy diagnosis in the students' problem solving processes. Following from their focus on identifying the affected structure, the most common co-occurrence involved ruling out a structure that had

previously been identified. Participants' identification of impairments as contributing factors follows closely from the elements of physical therapy diagnosis presented in the literature (Delitto & Snyder-Mackler, 1995; Guccione, 1991; Sahrmann, 1988). Students also frequently linked a structure (such as a specific muscle) to a pathology (such as a strain). This pattern continued into their final assessments. Table 5.1 summarizes the most common co-occurrences.

Table 5.1: Code co-occurrences of hypothesis codes

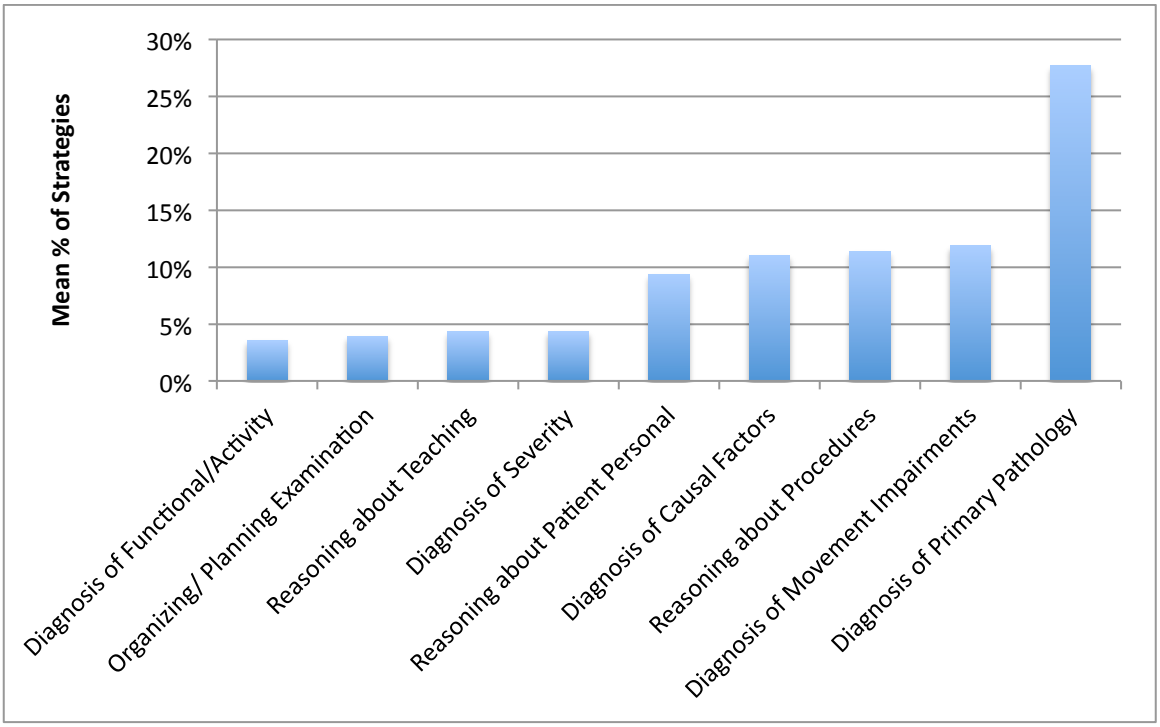
	Ruling Out	Contributing Factors	Activity ability/ restriction	Impairment (body function)	Pathology/ Medical Diagnosis	Structure
Ruling Out		3	1	10	9	22
Contributing Factors	3		9	18	6	8
Activity ability/ restriction	1	9				1
Impairment (body function)	10	18			6	7
Pathology/ Medical Diagnosis	9	6		6		16
Structure	22	8	1	7	16	

Reasoning Strategies

Participants' reasoning strategies further demonstrated their focus during the patient encounter. The most common reasoning strategy was Diagnostic Reasoning, focused on diagnosis of the primary pathology. Students also frequently exhibited diagnosis of movement impairments, reasoning about procedures (identifying possible interventions and strategies for implementing the interventions), and diagnosis of causal factors (see Figure 5.3). Appendix I: Table 2 provides examples of these reasoning strategies. These patterns of reasoning strategies further demonstrate the students' focus on determining the patient's pathology and the movement patterns that contribute to and are affected by the pathology. Two participants (Lisa from

University B and Bethany from University A) demonstrated greater reasoning focused on identifying the patient's personal needs and impact of the pathology. As one source of triangulation, I compared each participant's reasoning strategies with his/her hypotheses (described above). Participants demonstrated consistent patterns of hypotheses related to their reasoning strategies. For example, a participant generated a hypothesis regarding the anatomical structure at fault following the use of the reasoning strategy "diagnosis of primary pathology."

Figure 5.3: Reasoning strategies employed

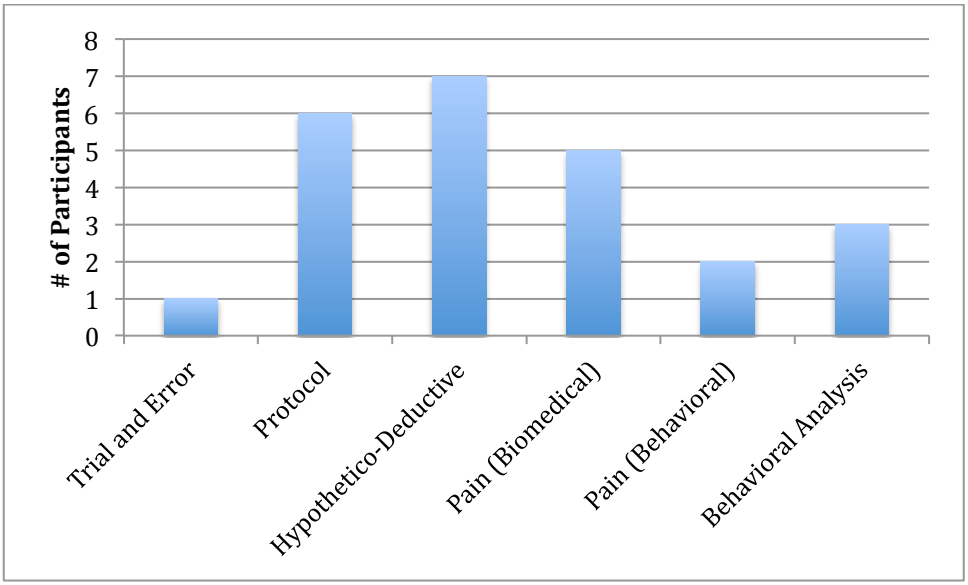


Overall Reasoning Patterns

I identified the participants' overall patterns of reasoning through analysis of the organization of reasoning strategies employed and hypotheses developed by each participant. Five primary patterns of reasoning emerged including: trial and error, following protocol, the

hypothetico-deductive process, reasoning about pain, and analysis of patient behavioral patterns. Figure 5.4 presents the overall distribution of reasoning patterns.

Figure 5.4: Reasoning patterns



Trial and Error. One participant demonstrated a significant use of trial and error in her work with the patient. Bethany (from University A) had initiated her examination by creating a list of items she wished to address, but was unable to adapt her process to the patient's needs. Bethany seemed thrown off by the patient's pain, and dropped several tests in process to avoid causing pain. When she conducted a test that elicited the patient's pain, Bethany was unable to form any assessment from that test, as she didn't feel that she had been able to fully conduct the test. During the post-encounter interview, she explained her difficulty making sense of the case because it did not fit the cases she had seen in class.

> I kind of ruled out facet so I was debating between lumbar instability because of her forward flexion, hip flexion and lumbar flexion. With muscle strain, because it's so acute, I don't know what to do with her because I know we're getting to the treatment side of it, and I'm getting a little nervous so like what am I going to do now, I don't know. I need to ask somebody because her presentation doesn't really fit what we learned in class.

Bethany further carried out numerous manual muscle tests for the purpose of "documentation." She also stopped three-quarters of the way through the examination and asked if a clinical instructor was available to assist her. Bethany demonstrated significant concern for the patient's privacy and personal needs throughout the examination but struggled to connect findings and planning.

Protocol. Six of the eight participants initiated their patient encounter by creating an examination form based off their memory of forms they had used in classes or clinical experiences. Mason (from University A) explained the notes he had written prior to meeting the patient:

> I was jotting things down because those little notes, they make sense to me, and that's what I would use to go back to write my initial evaluation to document I can go back and sort of like when we were taught to go through a typical evaluation exam an eval and we needed to hit these points, so I'm just kind of making a written note as to what the points are for documentation purposes, but also if I go back, say I do my exam, and I realized that I forgot to ask her something, I could look over there to see if I wrote it down or if I did forget to ask, I can ask it next time.

A seventh participant, Sophia (from University B), did not create a form, but during the interview she referred to information and structure from prior examination forms as part of what guided her examination process. Drawing on the structure of these examination forms helped participants organize their examination process and make sure they addressed the information they had learned was important during a patient evaluation. Most participants expressed that they were afraid they might forget to elicit important information from the patient if they did not write themselves the examination sheet as a reminder.

Hypothetico-Deductive Process. Participants demonstrated use of the established reasoning pattern, the hypothetico-deductive process, through their identification of multiple primary hypotheses with follow up testing to rule in or out selected hypotheses (Elstein et al.,

1978; Norman, 2005). Early in the patient interview, these participants generated multiple hypotheses regarding the source of the patient's pain and proceeded to ask questions and conduct tests to rule in or rule out the hypotheses they had generated. Chloe (from University B) demonstrated use of the hypothetico-deductive process in her explanation of her initial thought process:

> I was thinking of the different referrals, so it could be low back, it could be SIJ, it could be hip just kind of the different "radiculopathy" or facet. Just all the things that it could have been.

As she gained more information about the case, she re-evaluated her hypotheses and identified additional tests that she wanted to rule in or out her current hypotheses. After learning that the patient had fallen at work, Chloe explained,

> It was more, now it's a trauma. Now it could be like a ligamentous or possibly a fracture something like that. So before I did do anything more intervention I would probably want to refer back to an X-ray, because she hadn't gotten one.

Chloe demonstrated the hypothetico-deductive process during her efforts to determine the patient's primary pathology (structure/pathology) by identifying possible hypotheses and gathering information to rule them in or out. Other participants such as Peter (from University B) demonstrated use of the hypothetico-deductive process to identify contributing factors that may be addressed during treatment. Peter explained why he chose to assess the patient's hip range of motion to determine if limitations at the hip were contributing to stress on the patient's back: "Because the hips can affect what's going on in the back and she if had limited range of motion in her hips that can put more strain in the back." Seven of the eight participants used this strategy of developing hypotheses and determining the data they needed to collect to support or refute their hypotheses throughout the patient encounter.

Reasoning About Pain. Participants demonstrated two distinct patterns of reasoning about pain that have been identified in the literature. First, all participants demonstrated a biomedical approach to reasoning about pain (Smart & Doody, 2007). This process included using the location and description of the patient's pain to develop hypotheses about the primary pathology. Hannah (from University B) demonstrated the biomedical approach to reasoning about pain as she explained her use of the patient's pain description in guiding her thinking.

> Because different structures causes different types of pain and I would like to know which structure is most likely caused her pain and her describing what it feels like can help differentiate…. Achy, I thought it could be muscle or joint but then the sharp made me think okay, there might be some involvement with the joint. Maybe a fracture or even just nerve involvement if it's like any other symptoms associated with it so I wanted to ask more about that.

Further, six participants used the patient's ratings of her pain to determine the level of severity of the injury. Finally, five participants also used the patient's ratings of her pain to set goals for treatment. Mason (from University A) explained that the patient's pain ratings could help him determine if his treatment had been effective

> I kind of have to have a range of a pain scale and pain is something I can document over time, like patients, if I see that her pain is going down over time, that is another objective measure I could use to be like alright the treatment seems to be working, so a couple different reasons.

Two participants demonstrated a behavioral approach to reasoning about pain in addition to the biomedical approach. The participants employing this reasoning strategy collected the same information from the patient regarding the location of her pain and her ratings of the intensity of the pain; however, they drew on this information to form assessments about the patient's behavioral responses to the pain and the patient's perspective on the pain. Lisa (from University B) interpreted the patient's ratings of the pain as an indication of how the patient reacts and perceives her injury.

> So the visual-analog scale obviously is very subjective, it's hard to compare one person to another but really for me it just gives me a good idea of how this person reacts to pain. What their idea of pain is. So at rest she gave it a 1 out of 10 and at best a 1 out of 10. That means it is bothering her all the time, which is good to know which is still kind of in that inflammatory phase, but it's a pretty low level, not too bad and then it's getting to a 7 or 8 out of 10 at the end of the day and that's a big jump and I am a little bit more inclined to believe her.

These different approaches to reasoning about pain demonstrate that even though all the participants collected similar data from the patient, their reasons for collecting that data and their interpretations differ.

Behavioral Analysis. The same two participants (from University B) who demonstrated a behavioral analysis approach to reasoning about pain also reasoned about the patient's overall behavioral responses. Their analysis of data collected from the patient including her immediate and current management of her back pain and her management of her diabetes demonstrated a focus on the patient's overall behavioral patterns that was not present in the other participants' work with the patient. For example, Lisa explained that the patient's current approach to managing her back pain provided insight into the patient's behavioral profile and how she would respond to a treatment program. Sophia similarly explained how she interpreted the patient's use of diet and exercise to manage her diabetes as evidence that she would be likely to follow through on a home exercise program.

> So that made me want to, especially ask, what type of exercise is she doing. But that, she's going to make those kinds of changes in her life that probably, her compliance is going to be a little bit better than someone who is not mindful of exercise or their diet.

Lisa and Sophia's focus on the patient's behavioral responses suggests their attention to the greater psychosocial factors, including the patient's perspective, that impact physical therapy intervention (Ferreira et al., 2013; Fuentes et al., 2014). No other participants demonstrated any form of reasoning about the patient's behavioral characteristics or responses.

Final Assessments

All participants' final assessments included identification of an anatomical structure, with most also identifying a medical diagnosis/pathology. Two participants (both from University A) identified sacroiliac dysfunction (the pathology the case was designed around) with the remaining six participants identifying a muscle strain (either strain of erector spinae or quadratus lumborum). One participant, Lisa (from University B), also included contributing factors (the patient's body mechanics) as part of her assessment. Most participants identified key elements of the physical therapy diagnosis (Guccione, 1991; Rothstein et al., 2003), including the mechanism of injury, contributing factors, or patient behavioral characteristics, in their overall impressions (described in the post encounter form), but did not specifically name these as part of their assessment. During the post encounter interview, participants confirmed the assessments they had written on their post-encounter forms.

Participants demonstrated four different approaches in proceeding from their examination findings to their final assessments. First, the two participants (from University A) who concluded that the patient had a sacroiliac joint dysfunction had conducted multiple sacroiliac joint provocation tests and cited literature supporting the assessment of sacroiliac joint dysfunction when multiple sacroiliac joint provocation tests were positive. Second, three of the students (from University B), who identified a muscle strain as their primary assessment of the patient, had conducted sacroiliac joint provocation tests, but cited the patient's apparent pelvic alignment as a reason to rule-out the sacroiliac joint dysfunction. Third, two of the participants (one from each university) who identified a muscle strain failed to conduct sacroiliac joint provocation tests and never considered sacroiliac joint dysfunction as one of their hypotheses. Finally, one participant (from University A), who also demonstrated reliance on of trial and error

during her interactions with the patient, conducted sacroiliac joint provocation tests but was unable to interpret them because they elicited the patient's pain. The participants' written justifications for their assessments supported their stated final assessments, yet none included rationale for ruling out competing hypotheses. This limited attention to ruling out competing hypotheses is also reflected in the participants' reasoning errors.

Reasoning Errors

The participants in this study demonstrated three patterns of reasoning errors during their encounter with the patient. These include failing to generate a key hypothesis, ruling out a hypothesis without sufficient reasoning, and hanging on to a hypothesis in the face of conflicting findings.

Participants demonstrated a failure to generate key ideas or hypotheses in their evaluation of both the patient's primary pathology and co-morbidities due to jumping quickly to one idea. This pattern followed closely from Croskerry's (2003) description of Confirmation Bias and Premature Closure. Mason (from University A) and Peter (from University B) never brought sacroiliac joint pathology into their lists of pathologies and never conducted any tests for sacroiliac joint involvement. These participants generated the hypothesis of a muscle strain early in their examination process and never considered alternate explanations. These participants conducted fewer tests and measures overall compared to the other participants. Both participants, however, later identified during an interview that they should have considered sacroiliac joint as a possible source of the patient's pain. Bethany (from University A) and Lisa (from University B) never inquired about the patient's other medical conditions and thus failed to elicit information about the patient's co-morbidity of diabetes. Kelly and Chloe (both from University A) gained information about the patient's diabetes but never asked any follow up questions

regarding management. As a result, these participants failed to consider how the patient's current reduction in activity level (due to the back pain) impacted her management of her diabetes.

One participant (Bethany from University A) demonstrated a pattern of dropping hypotheses without sufficient data to rule them out due to her inability to interpret any test that aggravated the patient's pain. For example, Bethany briefly considered sacroiliac joint dysfunction as a possible source of the patient's pain. The only sacroiliac joint test that she conducted was the "stork test" for sacroiliac joint instability. When the test provoked the patient's pain before she was able to fully assess the patient's mobility, Bethany stopped the test and dropped her hypothesis of sacroiliac joint dysfunction without any further follow up.

> So she was not able to stand on her left and lift her right, which means she was in pain. And when she was standing her on right and lifting the left, she was okay so then that tells me, well that doesn't really tell me anything because she's not able to perform it in a standardized way.

Following this pattern, Bethany failed to make any assessment based on her findings from that test. She also was unable to determine follow-up tests to clarify the results of the test.

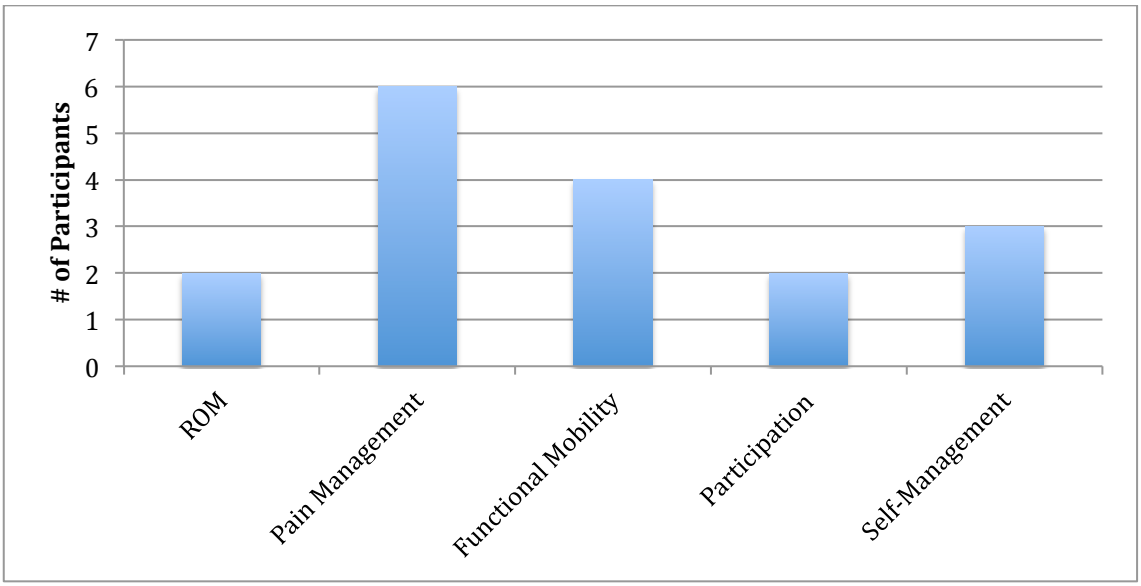
Four participants (three from University B and one from University A) maintained their hypothesis that the patient has a muscle strain despite gathering data that could suggest other reasons for the patient's pain. For example, all of these participants conducted at least one test that placed the patient in passive lumbar extension, a position that should not be aggravating to a strained extensor muscle, yet did not question their assessment of extensor muscle strain when passive extension provoked the patient's pain. These participants all found that the patient met their criteria for ruling in a muscle strain (pain with active contraction, pain when placed on stretch, and pain on palpation), yet they failed to consider other conditions that could also present with those findings.

Finally, participants also demonstrated different understandings of the process of making a diagnosis of sacroiliac joint dysfunction during their work with the patient. Two participants (from University A) weighted their reasoning primarily on the findings from the sacroiliac joint provocation tests and concluded that the patient has a sacroiliac joint dysfunction based on the provocation tests even though the patient had apparently normal pelvic alignment. Three participants (from University B) conducted sacroiliac joint provocation tests and repeatedly assessed the patient's pelvic alignment. These participants ruled-out their hypotheses of sacroiliac joint dysfunction based on the patient's apparent alignment in spite of the positive provocation tests. The participants discussion of their decision making process following the patient encounter indicated that these differences represent a difference in their learning of the necessary and sufficient conditions for ruling-in an sacroiliac joint dysfunction.

Goals, Interventions and Relations to Reasoning Processes

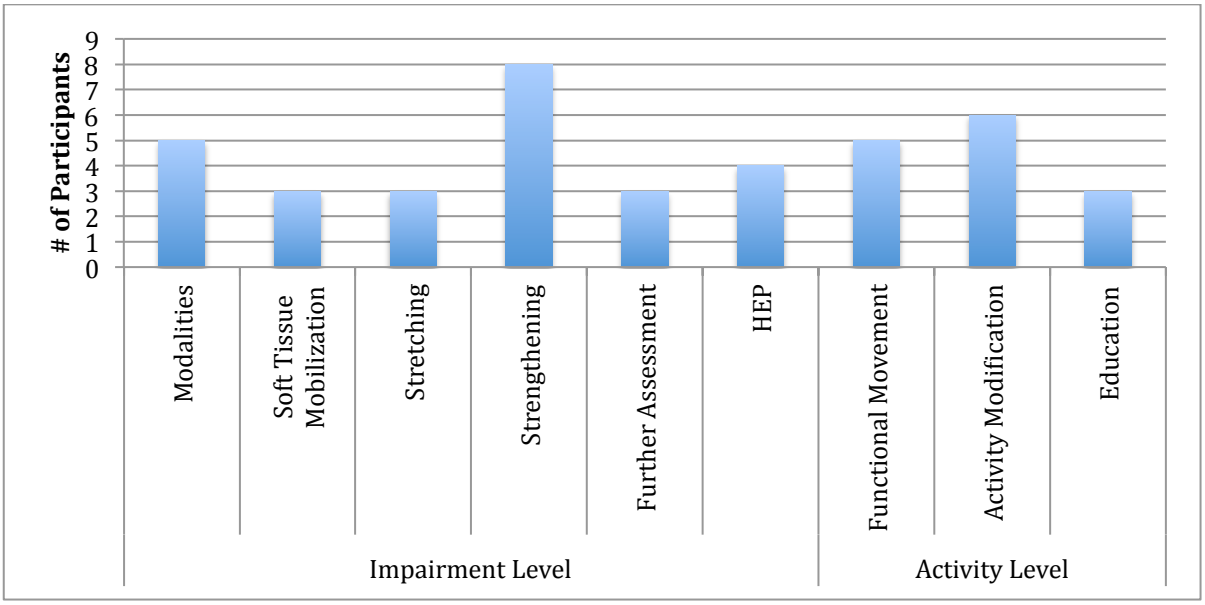
Goals. Participants described five primary categories of goals for their interventions with the patient. The most common goal was pain relief/pain management. This included reductions on pain rating scales during activities and at rest. Half of the participants included functional mobility related goals. These goals included activities such as improving gait or improving body mechanics while lifting objects. Three participants (from University B) emphasized patient understanding and self-management in their goals, commenting on the limited number of physical therapy sessions to which the patient had access. Two participants focused their goals on impairment measures such as trunk range of motion. Figure 5.5 presents the students' treatment goals.

Figure 5.5: Treatment goals



Interventions. The participants recommended a broad array of interventions for the patient. All participants included strengthening exercises of either trunk or hip musculature in their plans. All participants also addressed the activity level by including either functional movement training or activity modifications. Five participants also elected to use modalities (ice, electric stimulation or ultrasound) to manage the patient's pain. Half of the participants indicated they would create a home exercise program (focused on stretching and/or strengthening). Three participants, primarily the two who focused on muscle strain throughout their examination process, included soft tissue mobilization in their treatment plans. Three other participants indicated patient education was an important element of their plan. Each of the interventions identified addressed elements of the patient's needs, but only the three students who emphasized education took into account the significant role that patient understanding and self-efficacy have on the management of back pain (Daykin & Richardson, 2004; Linton & Shaw, 2011). Figure 5.6 displays the interventions the students selected.

Figure 5.6: Interventions planned



Relation of Goals and Interventions to Examination. The relationship between participants' interventions, goals and examination data revealed both strengths and limitations of their reasoning processes. The interventions a physical therapist selects should be guided by the examination data and evaluations (Riddle, Rothstein, & Echternach, 2003). The relationship between the students' examination data and interventions indicates some students have made greater progress towards effective selection of interventions than others have.

Six of the eight participants formed goals that followed from examination data collected and hypotheses formed, and selected interventions based on the goals and examination data selected. For example, Hannah (from University B) identified poor body mechanics, impairments that contribute to the injury, and patient behavioral and movement characteristics within the hypotheses she formed. Her goals for the patient followed from these hypotheses and included patient understanding and self-management, reduced pain, improved body mechanics, and a return to hiking. Hannah related her interventions directly to the goals she set. Her interventions included stretching tight muscles and strengthening weak muscles (identified in the

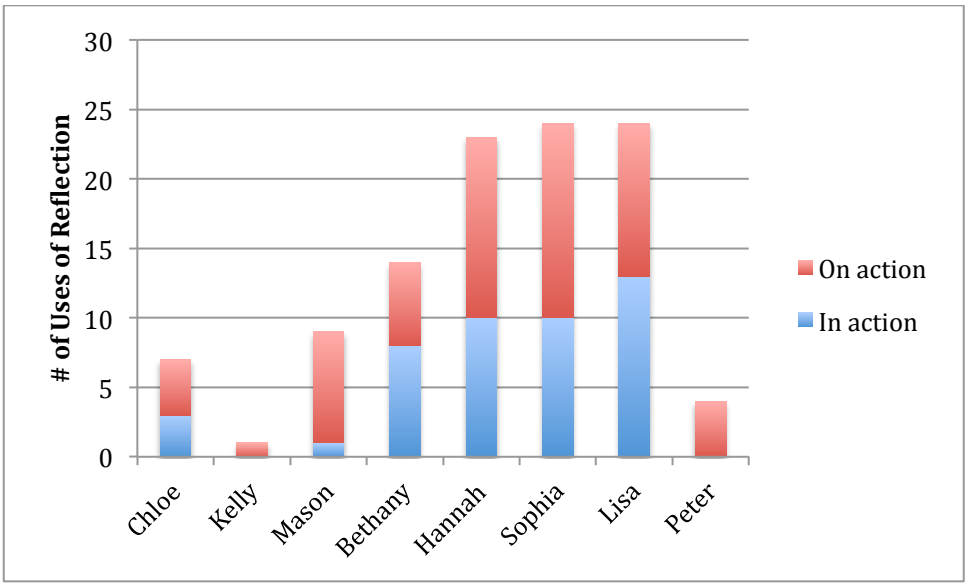
examination), training and education on functional movements (to address body mechanics), and patient education (to support the patient's self-management and awareness).

Two participants, however, demonstrated disconnections between their examination process and intervention selection. Kelly (from University A), for example, focused her examination on identifying the primary pathology and did not include any functional movement or strength assessments. Her goals, however, addressed participation, and she described interventions focused on strengthening and functional activities. The most common disconnection between examination data and goals/interventions was the inclusion of functional activity goals and interventions without an assessment of those movements. Four participants had the patient perform an active forward flexion range of motion (a measure of impairment) and later indicated that constituted their functional movement assessment. This interchanging of impairments and functional assessments suggests gaps in the students' understanding of the importance of functional movement in physical therapy assessment and intervention (E. D. de Bruin & Murer, 2007; Willy & Davis, 2011).

Reflection

Students' responses during the post-encounter interview indicated their use of both reflection in-action and reflection on-action (Schon, 1983) during the patient encounter. This use of reflection shaped their clinical decisions through their assessment of their in-the-moment decision-making as well as their ability to draw on prior experiences to inform their decisions. Figure 5.7 depicts students' overall use of reflection in- and on-action.

Figure 5.7: Participants' use of reflection



Reflection in-action. Students demonstrated reflection in action through their assessment and questioning of their findings and decisions during the patient session. Some used reflection to re-evaluate conclusions they had drawn from prior tests or to consider tests they needed to re-visit. Hannah (from University B) explained:

> I wanted to see if maybe I missed something at the beginning. And based on the way that she was bending, I wanted to see if she had any anterior tilt because before I was just kind of looking at if things are even between the sides but now I wanted to see if okay if something is contributing to the way she's moving that's limiting it.

Other participants actively debated the merits of following clinical wisdom over what they had read in research as they made decisions during their work with the patient. Lisa (from University B) explained:

> The fall, I especially wanted to see, sometimes with a fall onto one side or the other you can cause a little bit of a jarring with that SI and her pain the way she was pointing to her pain I wanted to see if there was any mal alignment there. I know that the research is all over the place with SI stuff but I've seen enough patients feel better after you do a mobilization or an MET (muscle energy technique) and I think it's worth looking at in terms of pain relief.

The participants who demonstrated reflection in action demonstrated a greater ability to adapt their examination and evaluation process to the unfolding findings, suggesting greater development towards the type of practice evident in experienced clinicians (Jensen et al., 1992). Peter (from University B) and Mason and Kelly (from University A) demonstrated the least reflection in action and also demonstrated the most "linear" rule-driven approach to reasoning that is typically evident in novices (Conger & Mezza, 1996; Jensen et al., 1992).

Reflection on-action. Students demonstrated reflection on action as they re-assessed their immediate actions during the patient assessment and drew on prior experiences with patients from classes or clinical affiliations. These patterns parallel Wainwright et al.'s (2010) findings of Reflection on Specific Action and Reflection on Professional Experience in novice and experienced clinicians. As Wainwright et al. (2010) described, reflection on specific action involved thinking back on a specific action or decision from the patient encounter and envisioning modifications. Reflection on professional experience involved comments related to the impact of prior clinical experiences on decisions made during the patient encounter.

Reflection on Specific Action. The students demonstrated reflection on specific action as they re-evaluated decisions they had made during the immediate patient session. Bethany (from University A) demonstrated this reflection as she assessed her process through the patient examination:

> So I was thinking, what could that be? So dull and achy is definitely somatic… There's no numbness and tingling, which is good, but I'm not able to rule this out, because I was not able to do a full straight leg raise. Yeah just trying to see if anything fits into a pattern. But I did have a lot of going back and forth.

Peter (from University B) also re-assessed his selection of tests, re-evaluating decisions he wished he could change: "I would rule out SI. I think there's some tests I did that didn't give me pretty much information that I could've taken out, for example the side bend and the

extension actively." Students' descriptions of their use of reflection on specific action indicated the role of this reflection in supporting students in learning from their experiences to adapt and improve their work with future patients. Specifically, this type of reflection can help students build practice strategies and develop ongoing metacognitive habits essential for ongoing professional development (Jensen & Paschal, 2000; Kuiper, 2005).

Reflection on Professional Experience. The students who had more clinical experience demonstrated greater use of reflection on professional experience as they drew on specific prior examples of patient experiences to guide their decision-making. For example, Lisa (from University B) identified prior patients' descriptions of pain patterns as an influence in her questioning of the current patient.

> So yeah, I guess a little bit from the clinic because patients will come in from the description like, I'm okay for the first while and then an hour later; I need to do something about it. I don't know where I heard that specifically, but it gives me an idea of how bad it is. If it's somebody that jumps up immediately to 10/10 and there's nothing you're going to do about it, it just tells me something about their pain and how they respond to it and how they think about it.

Sophia (from University B)'s approach to patient education was influenced by her reflection on prior patient experiences:

> A lot of people think they know how to correctly do things, sometimes they don't and also going through that handout a lot of times my patients have told me, oh that's the best thing you did was show me how to get in and out of the car and getting up and down the chair. And so just making sure that they know how to do things correctly. It's also something they can take home and use in their habits.

Students drew on their prior clinical experience to guide their interview and examination with the patient and to inform their selection of interventions.

Overall, students' use of reflection enabled them to draw on prior patient experiences and adapt their examination process to the specific current patient. Students' use of reflection on action demonstrated their learning from prior experiences (reflection on professional

experiences) and their potential to learn and change future practices based on their experiences with the current patient (reflection on specific action).

Discussion

This chapter has described students' actions and reasoning processes during their encounter with a standardized patient. Overall, students focused on identifying the patient's primary pathology and possible biomechanical or behavioral contributing factors. Students' treatment goals and interventions primarily followed from the examination data and hypotheses they formed during the patient examination. The following section discusses the relationship of the students' reasoning processes to physical therapy specific reasoning and the factors that may underlie these reasoning abilities. First, the students' reasoning processes suggest their progress towards physical therapy specific reasoning as well as limitations in their development. Second, the nature of the students' reasoning strategies supports the role of the four capacities (organized knowledge base, ability to interact with patients, decision-making under uncertainty, and a patient-centered orientation to practice) defined in the framework as supporting students' development of reasoning processes.

Development of Physical Therapy Specific Reasoning

Students demonstrated two of three key characteristics of established diagnostic patterns in physical therapy. Within physical therapy practice, diagnostic reasoning requires integration of a biomechanical/pathological analysis and the impact of the impairments on the patient's life function or disability (Jones et al., 2008). Key elements of this diagnostic process include identification of: movement impairments and their relation to the patient's physical function (Guccione, 1991), factors that contribute to the patient's problem (Rothstein et al., 2003), and ways that the patient's personal characteristics affect his/her level of disability (Guccione, 1991).

Students demonstrated a focus on movement analysis through their examination process, hypotheses, and interventions. This parallels the focus on movement in the reasoning of expert and novice physical therapists (Embrey et al., 1996; S. May et al., 2008). The students, however, demonstrated two different approaches to their reasoning about movement suggesting that some participants held different foci for their assessment processes. Four students focused exclusively on movement at the impairment level, such as identifying limitations in a forward bend or hip abduction strength. Three students, however, demonstrated greater attention to the patient's movement patterns and behaviors. These students' attention to movement patterns suggests progress towards the development of movement scripts identified in expert therapists (Embrey et al., 1996).

The hypotheses the students named most often further indicate their development of a physical therapy specific diagnostic process. The students' hypotheses focused on identifying affected anatomical structures and movement impairments that contribute to the patient's current condition. This focus indicates students' progress towards a physical therapy specific diagnostic process of identifying movement factors that contribute to the injury (Delitto & Snyder-Mackler, 1995; Guccione, 1991; A. M. Jette, 1989; Sahrmann, 1988). Further, the students' identification of movement impairments as contributing factors enabled them to develop interventions based on the hypotheses they had formed (Sahrmann, 1988).

The students demonstrated less attention to the impact of the patient's injury on her life function. Physical therapists must address the consequences of the patient's disease process in addition to the pathology itself (A. M. Jette, 1989), and this process includes understanding how the effects on physical function impact a patient's ability to carry out his/her life roles. Only three students, however, developed multiple hypotheses about the impact of the pathology on the

patient's life and the impact of the patient's personal characteristics on her function and prognosis. The students' attention to movement and impairments as contributing factors suggests that the students' are developing the analytical or technical aspects of the physical therapy diagnostic process, yet giving limited attention to the psychosocial components of the process.

The relationship of the participants' goals and interventions to their stated final assessments also suggests a mismatch between the participants' interpretation of the assessment and the physical therapy assessment and diagnosis defined in the literature (Rothstein et al., 2003; Sahrmann, 1988). All participants identified a pathology of an anatomical structure (a spinal muscle strain or sacroiliac joint dysfunction) as their final assessments. These final assessments did not directly bear on the goals set and interventions selected as the goals and interventions focused more at the level of impairments and functional/participation activities. During the examination process, the students developed hypotheses concerning the patient's impairments and activity limitations as well as contributing factors to the patient's injury, key aspects of the physical therapy diagnosis (Rothstein et al., 2003; Sahrmann, 1988). Only one participant, however, included those elements in her stated assessment. The participants' development of these hypotheses and their inclusion of interventions related to impairments as contributing factors indicate their understanding of this aspect of the physical therapy assessment process, yet their inclusion of only a pathology/anatomical structure (more akin to a medical diagnosis) in their named assessment suggests a disconnection between their enacted assessment process and their definition of physical therapy assessment.

Capacities for Clinical Reasoning

The students' successes and limitations during the patient encounter suggest that the four capacities for clinical reasoning (knowledge base organization, ability to manage decision

making under uncertainty, orientation to practice, and ability to interact with the patient) influenced how students carried out clinical reasoning and patient care. First, the students' knowledge of factors related to the patient's condition impacted their ability to draw meaningful conclusions from the tests they conducted. Second, the students' use of reflection affected their abilities to critically analyze and integrate ideas during the patient session. Third, the students' demonstrated qualitatively different approaches to the patient encounter, indicative of biomedical and biopsychosocial models of practice. Finally, the students' demonstrated limited variation in their interactions with the patient. The following section examines how each capacity impacted the students' reasoning and decision making during the patient encounter.

Organization and Accessibility of Knowledge. Students' abilities to organize and link ideas also influenced their effectiveness in evaluating the patient. Most students demonstrated use of the hypothetico-deductive process throughout their patient assessments, similar to the practice of novice clinicians (Coderre et al., 2003; Doody & McAteer, 2002; Wainwright et al., 2011). Knowledge of linking pain presentation, aggravating and easing factors to tests and observations impacted students' evaluation processes. Specifically, whether the students had learned to give more weight to provocation tests or the patient's pelvic alignment in making a sacroiliac joint diagnosis impacted how they interpreted test results. Students in one program explained that they had learned that they needed five positive provocation tests in order to conclude sacroiliac joint involvement. The students from this program who conducted the tests drew the sacroiliac joint conclusion. Students in the second program described learning a greater focus on pelvic alignment and gave greater weight to pelvic alignment than positive provocation tests, leading them to rule-out the SIJ diagnosis. These findings suggest that the content and organization of students' classroom learning impacted the way they connected their knowledge

to the clinical case (Custers, 2010; Mandin et al., 1997; Norman, 2009). Additionally, students' abilities to link the patient's descriptions of her injury to possible pathologies impacted their progression through the patient evaluation. The two students who failed to generate any sacroiliac joint hypotheses never conducted tests that would refute their primary idea of a muscle strain. Two students demonstrated uncertainty in the process of conducting and interpreting the tests that suggested limited depth in understanding the test such as failing to draw any conclusions from a test they could not conduct exactly as they had learned in class. These students' rule-driven approach to the patient assessment is representative of the novice approach to problem solving guided primarily by rules and protocols (Conger & Mezza, 1996; Jensen et al., 1990). These errors also parallel many of the cognitive biases noted in the work of clinicians (Croskerry, 2003). The three students who demonstrated greater depth to their examinations and assessments drew on knowledge from multiple domains (orthopedic pathology, biomechanics, psychology, motor learning, personal experience). Their use of a varied knowledge base suggests development towards the expert practice of integrating diverse knowledge sources for patient care (Resnik & Jensen, 2003; Rushton & Lindsay, 2010; Wainwright et al., 2010). Overall the students who were able to readily access their knowledge and flexibly organize their use of questioning, tests, and measure demonstrated the most thorough examination and assessment of the patient.

Managing Uncertainty with Reflection. Reflection in- and on-action influenced the students' processes through the evaluation process. Overall, students' reflection in-action took two primary forms. Four students used reflection to re-assess their actions and shift course during the examination, while one student reflected on her own limitations and desire for external guidance from a clinical instructor. Students who engaged in reflection in-action questioned findings and

re-evaluated (or re-examined) certain tests or examinations. These students demonstrated greater flexibility in their progress through the case and were able to adapt their tests and measures to the unfolding situation (Schon, 1983; Wainwright et al., 2010). While the students reflected on their own use and interpretation of tests and measures, only two considered possible conflicts of values between their interests and the patient's. These students' use of reflection in-action suggests the students are making progress in the development of more complex reflection in action as described in experienced clinicians (Embrey et al., 1996; Rushton & Lindsay, 2010; Smith et al., 2008a; Unsworth, 2001). One student, who also demonstrated the least knowledge regarding the case, indicated at multiple points during the examination and interview that she would have felt more confident with a supervisor present. While these comments indicate limitations in this student's own capacities for clinical reasoning, they also indicate her awareness of her limitations, which may enable her to seek the appropriate learning situations that she needs.

Students' use of reflection on professional experience suggests the role of reflection on-action in building their clinical knowledge scripts. Experienced health care providers frequently draw on scripts that contain complex inter-woven networks of knowledge, including enabling factors for particular diagnostic categories, and examples of specific prior patients during their interactions with new patients (Mandin et al., 1997; Schmidt et al., 1990; Schmidt & Rikers, 2007). Specific to physical therapy, expert clinicians develop these scripts around patient movement patterns (Embrey et al., 1996; McGinnis et al., 2009; Riolo, 1996; Wainwright & McGinnis, 2009). Students who reflected on professional experience engaged that experience to enhance their exploration of the current patient. Students typically engaged this reflection by drawing on prior experiences with patients who shared similarities with the current patient.

Insights from these prior patient experiences enabled the students to make connections in both the biomedical and behavioral domains. Students used their knowledge of prior specific patients to guide their process through the examination in terms of selecting appropriate tests and measures. Students also reflected on specific prior patients as they interpreted the standardized patients' personal characteristics and behavioral responses. The students' use of reflection indicates a significant role for reflection on professional experience in students' development of illness and incidence scripts (Mandin et al., 1997; Schmidt et al., 1990).

Students' use of reflection on specific action suggests that they viewed their work on the standardized patient as an opportunity to continue to improve their clinical reasoning skills. Students' reflection on specific action primarily focused on analysis of clinical decisions they believed were effective, or those they would change if given an opportunity to re-visit the patient scenario. This use of reflection suggests the students have the capacity to learn from their clinical experiences, as Shulman (2004) suggested that the reflection on-experience, not the experience alone, fosters learning. Overall, students' use of reflection influenced their progress through the immediate patient case and the connections they drew to prior experiences.

Approaches to the Patient Encounter. Students demonstrated different overall approaches to the patient encounter. These differences illustrate Schon's theory that real world problem solving involves first framing the problem, then solving it (Schon, 1983). The two primary approaches to the patient encounter were the biomedical approach and the behavioral approach. Students demonstrating the biomedical approach focused their examination and hypothesis development around identifying the patient's primary pathology. These students' treatment plans also focused on the biomechanical and impairment levels. Three students demonstrated a greater focus on identifying patient behavioral characteristics that impact movement and treatment. These

students included greater attention to patient education and activity modification in their treatment plans. These students' educational approach to patient treatment suggests they may be developing some of the characteristics of more expert practitioners, even at this early stage of their education (Jensen et al., 1992; Resnik & Jensen, 2003). Although all participants collected similar data during their examinations, their interpretation and use of that data suggests different approaches to framing the clinical problem. For example, all students asked the patient to rate her levels of pain. Six students used this information as an indication of the severity of the patient's injury and a measure for progress. Two students, on the other hand, used the pain ratings to gain insight into the patient's perceptions of and behavioral responses to the injury. Students' orientations to practice likely influence these approaches, as the following chapter will explore.

Interactions with the Patient. The standardized patient scenario provided limited insights into the students' interactions with the patient. Students primarily focused on gaining the information (either verbally or through tests) required to make an assessment. Students devoted little to no time to social interactions or relationship building with the patient. A scenario with repeat visits and full treatment sessions may better allow assessment of interactions. The students' interactions in this study, however, do parallel the findings of Roberts et al. (2013) wherein clinicians dominated the conversation with patients and the content of interactions focused on gathering and clarifying information. Further, observations of students during actual clinical encounters in the field would provide richer data on patient interactions.

Conclusion

The findings from this chapter support the proposed model of clinical reasoning. Students' ability to draw on relevant knowledge and generate appropriate hypotheses affected

their process through the case. Students' engagement of reflection both in- and on-action affected their ability to question findings and draw on prior experiences to guide their process through the patient encounter. Finally, students demonstrated qualitatively different foci in their work with the patient, suggesting different models of practice underlying their actions. In the following chapter, I examine the relationship of the participants' characterizations of practice to their reasoning and decision making during the patient encounter.

Chapter 6

Characterizations and Practice

In medical practice the physicians' or medical students' orientations to the patient-practitioner relationship influence what they consider acceptable to discuss with the patient (Dall'alba, 2002). Physical therapists' underlying assumptions and understandings influence how they collect and interpret information in clinical situations (Edwards et al., 2006). PT students' conceptualizations of practice likely influence their approaches to clinical reasoning, yet no studies to date have directly compared PT students' characterizations of physical therapy practice with to their clinical decisions. This chapter addresses the question: What is the relationship between PT students' characterizations of practice and their clinical decisions during an encounter with a patient?

Findings

In this section I first describe the relationship between the participants' overall characterizations of practice and their approach to the patient encounter based on their hypotheses and reasoning strategies during the standardized patient session. I then present five case studies illustrating the relations of characterizations and actions described. Finally, I present data on the relationship between students' characterizations of the purpose of the encounter and their use of reflection (in-and on-action) during the patient encounter.

Overall Characterization of Practice and Approach to Encounter

The participants' clinical actions and reasoning strategies during the patient encounter followed five patterns that paralleled their characterizations of practice. First, the three participants (Bethany and Kelly (from University A) and Peter (from University B)) whose characterizations of practice emphasized the need for problem solving and diagnosing and fixing

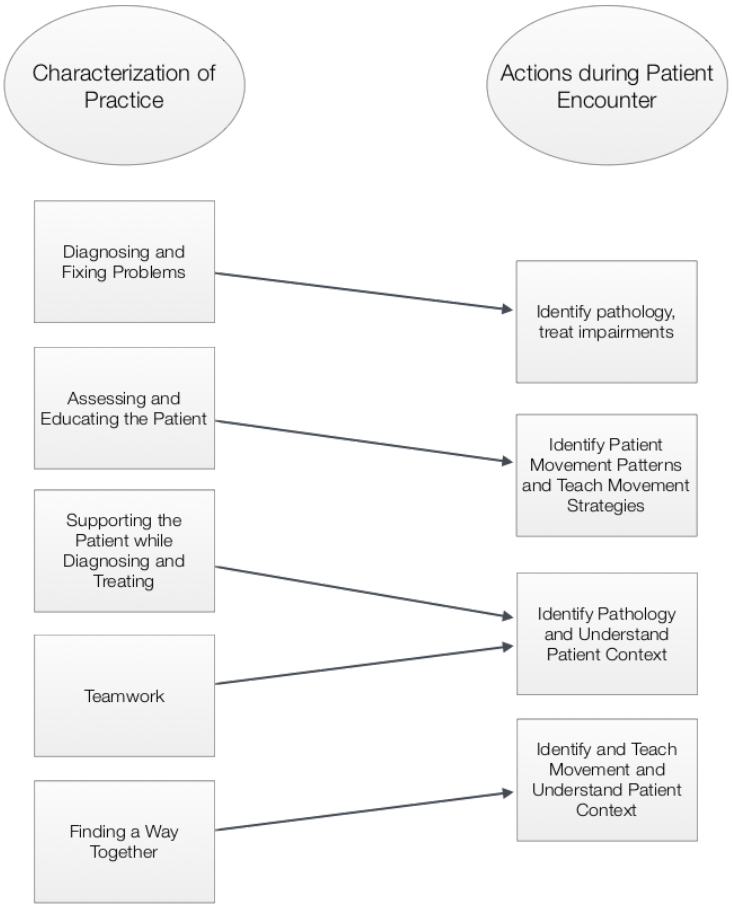
problems engaged primarily in diagnostic reasoning focused on the primary pathology. These participants also formed the least number of hypotheses regarding patient characteristics or patient perspective. The case study of Peter (from University B) (see following section) illustrates this pattern. Second, the two participants (Lisa and Hannah from University B) whose characterizations focused on assessing and educating the patient included frequent mentions of patient characteristics during their hypothesis formation. They both also frequently demonstrated reasoning about the patient's movement patterns and movement impairments. Third, the one participant (Chloe from University A) whose characterizations of practice focused on supporting the patient while diagnosing and treating used reasoning strategies that focused on the diagnosis of the primary pathology but also frequently demonstrated reasoning about the patient's personal needs. The case study of Chloe provides examples of this pattern. Fourth, the one participant (Sophia from University B) who characterized practice as finding a way together had the greatest use of narrative reasoning and reasoning about the patient's personal needs, suggesting that she gave a higher level of attention to understanding the patient's experience. Examples of Sophia's characterizations and practice are presented in the following section. Chloe and Sophia were also the only participants to inquire about the patient's living situation and social support during the patient encounter, indicating their concern for the patient's overall well being in addition to her physical condition. Finally, the one participant (Bethany from University A) who emphasized teamwork throughout her characterizations of practice also drew primarily on diagnostic reasoning about the primary pathology and reasoning about the patient's personal needs. Bethany also demonstrated the greatest concern for the patient's need for privacy and unwillingness to place the patient in any position that caused pain. Bethany's concern for the patient's pain, however, limited her ability to effectively conduct her assessment as I describe in

her case study below. Table 6.1 contains summary statements for each participant's characterization of practice and overall approach to the patient encounter (based on the reasoning strategies and hypotheses described) that demonstrate the patterns described in this section for each participant. Figure 6.1 illustrates the relations.

Table 6.1: Relation of characterizations and practice

Participant	Overall Characterization	Approach to Encounter
Kelly	Fixing problems: PT has knowledge, patient needs to learn and do	Examination very medical diagnosis focused (no impairment or functional level testing)
Mason	Fixing the mechanical problems: PT has knowledge, patient needs to follow (compliance)	Patient encounter focuses on making diagnosis and treatment aimed directly at tissue pathology
Peter	Fixing the mechanical problems: PT has knowledge, patient needs to follow	No functional activity testing, focus on identifying pathology, some impairment testing
Hannah	Improving physical function, patient needs to learn from PT, some room for patient input	Practice focused on assessing and educating the patient on movement patterns
Lisa	Movement educator: PT has knowledge, patient needs to learn and understand	Patient encounter focuses on behavior and movement re-education
Chloe	Support and advocate for the patient	Biomedical approach to pathology alongside support for patient (only student to enquire about living situation, social support)
Sophia	Listening is as important as treatment, treat the whole person. Patient is learning how to move appropriately	Patient encounter focus on teaching with support for patient. Considered the patient's perspective and behavioral responses during the encounter
Bethany	Building connections: Improving quality of life, highly relational	Hesitant to cause any pain to patient, but unable to adapt examination to generate effective data, Low confidence, difficulty with knowledge base

Figure 6.1: Relation of characterizations and practice



Case Studies

Peter (from University B): Diagnosing and fixing problems. Peter focused on solving and fixing problems. He began his interview by explaining that the purpose of physical therapy was to return patients to physical activities. He explained,

> If they (the patients) have had an accident or injury and they're not able to do things that they used to be able to do, physical therapy would help them get back to that example, or return to walking, or mobility, stuff like that.

His focus on fixing problems and addressing physical function carried over into his metaphor where he explained the work of a PT was like that of a car mechanic. When a patient comes to a physical therapist, he compares the process to "Someone brings in their car, it's broken, and a physical therapist is expected to put it back together and fix it, so it's running like

new, if not new, as good as you can get back, just repair it." Following his characterization of physical therapy practice as solving mechanical problems, he focused his work with the standardized patient on identifying her pathology and the impairments that contributed to it. This approach was evident in his hypotheses where pathology, impairments, and contributing factors were his three most frequently identified hypotheses. His reasoning strategies also focused primarily on diagnosing the primary pathology and determining procedures to treat the patient. During his encounter with the patient, he used the patient's descriptions of her condition to hone in on the pathology. For example, when she described her pain, he drew on the information to identify injured structures.

> Well, achiness didn't really, it drove me away from thinking nerve because a nerve I would think that would be more described as a numbness or tingling or radiating, so when she said achiness I thought that you know again it was just more muscles that were kind of damaged from the fall.

His examination process followed his focus on identifying the injured anatomical structure. He did not ask the patient any questions about her living or social situation, nor did he assess her performance of any functional activities, suggesting his continued focus on diagnosing a biomedical problem. As he transitioned to treatment, he aimed his interventions directly at repairing the affected tissue. He explained to the patient as he initiated his treatment.

> We have some techniques here that we can help the healing, move it along a little bit. Yeah I think it's just a muscle strain and some activity modification would be best. I'm going to do some, ultrasound for you. Which, the way the ultrasound works is, it basically emits sound waves into that damaged tissue and that helps uh bring more blood into the area to sort of speed up the healing process.

His treatment focused on the mechanical nature of the injury. He explained after the patient session that he would start with activity modification to unload the tissue, some soft tissue mobilization to heal the muscle, and exercises for the patient to reduce the stress on the injured tissue. Both Peter's descriptions of physical therapy practice and his actions and

reasoning strategies during the patient encounter indicate his technical view of physical therapy practice focused on diagnosing a biomedical problem and providing treatment to heal an injured tissue.

Lisa (from University B): Assess and educate the patient. Lisa consistently described physical therapy practice with a focus on teaching patients more effective ways to move. She described the explicit purpose of physical therapy as:

> I think PT is all about finding the most efficient and pain free way for people to move, so it's all about moving around in your day, humans are meant to move and how can we make their, a person's movement efficient, so that they're not wasting a lot of energy.

In her descriptions of typical patient encounters, Lisa explained that not only should physical therapy practice enhance human movement but also that the role of the physical therapist is to educate the patient regarding the most efficient ways to move. She described her ideal outcome in physical therapy as the patient gaining independence in understanding how to manage his/her own movement habits.

> So orthopedic practice, my ideal outcome would be to give the patient tools to note when they're going into a painful cycle or when they're falling into old habits, so they could correct for it and treat whatever their symptoms are at that point in time.

Throughout the patient encounter, Lisa demonstrated this approach to assessing the patient's movement patterns and educating the patient on more effective movements. She used typical tests and measures, such as active range of motion, to gain insight into the patient's willingness to move. She explained her thought process after observing the patient perform an active forward flexion.

> Yeah, so I wanted to see how willing she was to move for one thing. Not very willing to move. Very cautious with bending forward, which is always an interesting thing with somebody who says they are crouching things to pick up pots and pans from underneath. And then you ask them to do a forward bend, "oh it hurts". Okay, well you're grunting through it throughout the day, so to me you're probably pushing through a pain a little bit

> too much throughout your day because that's not a good thing because clearly with she got about 50 percent flection before she's like, 'Oh that hurts. I need to come out of it.' Well that's different; you know just isolated movement versus functional movement. Sometimes people do that. They will push through because their job requires it. And then when I looked from the back they went a little bit off to the left and she really wanted to bend that left knee.

Lisa drew on information about the patient's responses to the injury and ongoing pain as opportunities to educate the patient about self-management of her condition. When she learned that the patient was currently doing only minimal self-care to manage her back pain, Lisa explained the importance of education.

> Yeah she said rest and she sometimes takes Advil. I think it just lets me know that she is not really sure how to take care of her body when it gets injured. She just hopes for it to go away, which is a great thing for PT, because it gives us so many things to work with. Just sort of a reminder, okay education is going to be a big thing with this patient.

As Lisa transitioned into her treatment plan, she explained to the patient what she had observed during the examination and her ideas for initial treatment. After the encounter she explained that she believed it was important for the patient to understand the role of her movement patterns in the recovery process. Lisa further explained that she hoped that helping the patient understand the connections would contribute to the patient's follow through with home exercises.

> I think it's good for them to know what is going on in my mind. For PT especially, these exercises, for someone who doesn't understand their body very well, who doesn't understand their exercise very well, who doesn't understand really how poor motor control is going to effect their ability to recover from an injury. It can seem really bizarre. You know if I have a person who comes in, especially with low back, and I immediately start giving them a hip flexor stretch and abdominal exercises, they are like what on earth is this going to do for me. But it's important to sell them what's going on. Otherwise, especially for someone who's on a home program, they are not going to do it.

Lisa explained that her highest priority in treatment was for the patient to learn more appropriate body mechanics and skills for self-management of her back pain. She explained her decision based on the patient's situation.

> Yeah because especially with a patient like this, if we're trying to get them out and into a home program quickly just for cost reduction, not expecting her to be 100% by the time I'm done. Just realistically, but knowing they have tools and knowing that they're consciously thinking at work about positioning, reaching, bending, things that bother it normally. If she's constantly thinking okay I need to move in a better way, then I'm like great, this is a person who's a little bit better about taking care of themselves. Independent.

Throughout her interactions, Lisa engaged in a practice that illustrated her characterizations of physical therapy. In both her interview descriptions and her clinical decisions and reasoning processes, Lisa prioritized movement analysis and educating her patient regarding their movement and self-management of their conditions.

Chloe (from University A): Support the patient while diagnosing and treating.

Through her interview and her interactions with the standardized patient, Chloe demonstrated an approach to physical therapy practice that included psychological support for the patient while assessing and treating medical problems. Chloe's descriptions of physical therapy practice contained a mix of patient advocacy and more traditional treatment. Chloe identified the purpose of physical therapy as enhancing the patient's quality of life in addition to physical function.

> I think it's about improving quality of life and it's you know not just working out and strengthening what's weak and you know stretching what's tight, it's about the experience and enhancing the human experience that is you know being able to participate and have fun with physical therapy.

Her mix of holistic and technical was also evident in her explanation of her view of the patient's role in therapy. She explained that she expected her patients to have an open mind to her interventions. While she describes the PT as determining the interventions, she considered the patient's perspective.

> I mean I guess maybe working with something they've never worked on before or you know cause I'm sure not everybody has a body weight supporting treadmill and it might look a little intimidating or something like that, so hopefully they would have an open mind to trying new things and trying things that may be uncomfortable or things like that, that's what I really enjoy about my patient in clinic is she's always willing to do one

> more and if I say hey do you wanna try this, have you done this since your incident, and she's like no, but yes I wanna try it, she's always like sure I'll try it, and I'm like if it doesn't work then we know, but at least we can try.

Throughout her descriptions of practice, Chloe highlighted the role of the PT in making assessments and designing interventions for the patient while listening to the patient's input and supporting him/her as a person. This characterization carried over into her work with the standardized patient. Chloe explained her approach to asking an open ended introductory question to the patient as "Just a broad question to get the conversation going, you know, what happened to her and what the story is." Her approach to asking the patient about topics besides her direct injury continued through her interview with the patient. For example, after learning that the patient was employed as a chef, she asked about the restaurant at which the patient worked. Chloe's explanation for these questions: "Just to get rapport going." Chloe also considered the patient's personal level of comfort as she transitions into her examination. Prior to assessing the patient's posture, she asked if the patient was OK with exposing her back and trunk. Chloe explained her reasons for asking prior to moving forward.

> Just to see what her comfort level is, obviously if she doesn't want to, I mean it is easier for us to see a posture, do a postural assessment if there is less close on. But obviously keeping the patient's modesty in considering that is important.

She continues this concern for the patient as she explained her rationale for thoroughly explaining procedures to the patient prior to touching her.

> Just to let her know, I guess to make her feel more comfortable about what I am doing to her because I am going to be touching her body and if I have already gotten a, "I don't want to take off my clothes" maybe she doesn't want me to touch her either, so she might. Just to make sure the patient is comfortable. I want to make sure everything is okay before I go ahead and do it.

Throughout the examination Chloe checks in with the patient about her level of comfort with the procedures. The process of Chloe's examination and treatment, however, focus more on

the level of identifying and treating a pathology. As she examines the patient's movement and conducts orthopedic tests, Chloe consistently explains her process in terms of identifying the injured anatomical structure and the nature of the pathology. As she observed the patient performing spinal flexion, she linked her observations to biomechanical processes.

> It kind of affected, well she was kind of, it brought on her pain, it made me think, maybe it is something with the lower back and then she kind of deviated to the right with extension. Maybe a closing restriction.

Following this line of thought, Chloe's hypotheses focused on identifying impairments, contributing factors, and determining interventions. Her reasoning strategies continued the pattern of determining a medical diagnosis and treatment as she primarily drew on diagnostic reasoning about the primary pathology, movement impairments, and contributing factors. Chloe's plan for treatment followed from her medical and biomechanical attention throughout the examination. She placed the highest priority on managing the patient's pain and added goals related to the patient's range of motion and mobility. Overall, Chloe's approach to the patient encounter paralleled her descriptions of practice. She paid attention to the patient's psychological and personal needs yet conducted a routine physical therapy examination focused on identifying the patient's pathology and impairments. This separation of psychosocial issues from the biomedical, similar to the actions of many clinicians, may represent a limited understanding of the biopsychosocial model (Singla, Jones, Edwards, & Kumar, 2014). Her characterizations and her practice included both the psychological and physical aspects of therapy yet maintained them as separate entities.

Sophia (from University B): Working together with the patient. Sophia demonstrated an emphasis on supporting patients while working with them to help them learn how to move more effectively in both her interview and her interactions with the standardized patient. Sophia

began her interview by explaining that physical therapy was about helping people learn and adapt to accomplish what they want in life.

> Really helping people readjust and relearn how to move so that they can accomplish what they want to do in life. Whether it's how to get up out of a chair correctly because you have back pain or is it just walking again after having your knee replaced, I've mostly seen ortho at this point, so that's my perspective right now, so and sometimes it's you're coming in and you're talking to your patient about okay how are you going to get your exercises done at home and I've had homeless patients in the past and so sometimes you're working as not jus their physical therapist, but like just someone to talk to.

Her characterization of practice moved beyond simply teaching patients to do exercises or assume postures correctly. As she described, she wanted patients to understand their bodies and their own ways of moving.

> …learning how to move better, learning so that the patient knows how to manage their symptoms, the patient knows their limits and what they shouldn't be doing, that they're actively trying to break their bad habits and when they, I always say that they're graduating from PT and so these are your exercises and I try to teach them where to go from there.

Sophia brought this perspective of the therapist as a teacher and supporter to her interactions with the standardized patient. Similar to Chloe, she opened with a broad question that did not focus on the injury on the referral. As she explained,

> I think it helps them kind of get more of a story, some people aren't big talkers and some people are so I kind of want to see what their side of the story is rather than just low back pain.

As Sophia moved through her interview and examination with the patient, she used her questions and assessments to gain more information about the patient's behavioral responses and understand how to best work with that patient. She explained her reasoning for asking the patient about how she responded immediately after the fall at work.

> So I can see how she was reacting. Did she automatically think, "okay I need to ice this," or you know some people prefer heat for pain. Or did she continue on with her day, which it sounds like she did and when she got home at the end of the day, she rested… So that's going to be a little bit of a barrier because, you know, she has a job so she has to

> work through her jobs. Teaching her different tips at work, you know, giving yourself a little rest when you can. Or I want to know if she was on lighter duty or maybe she could give over some responsibilities to somebody else. But it was nice that she did rest at the end of the day. Like she knew she needed to give her body some rest.

Sophia's assessment process focused on her gaining an understanding of the patient's life situation and responses to movement. Throughout the patient session, her hypotheses focused on identifying movement impairments and patient characteristics that impact the injury. Likewise, she primarily drew on diagnostic reasoning about the pathology and movement impairments, but also drew extensively on reasoning about the patient's personal needs. Her focus on understanding the patient's situation was also evident in her explanation for asking about the patient's living situation. When Sophia learned that the patient lived alone, she explained,

> You know, there's no one at home that's going to bug her about doing her exercises. And then you know she has all those household things she has to do on her own, there's no help at home. Putting away the groceries can be a problem. She's the only one that's going to do that.

Drawing on her understanding of the current patient and her experiences with prior patients, Sophia focused her interventions on helping the patient develop strategies to move more effectively for the tasks she needed to do. She explained her decision to give the patient a handout on body mechanics:

> A lot of people think they know how to correctly do things, sometimes they don't and also going through that handout a lot of times my patients have told me, oh that's the best thing you did was show me how to get in and out of the car and getting up and down the chair. And so just making sure that they know how to do things correctly. It's also something they can take home and use in their habits.

Throughout her interactions with the patient, Sophia worked to understand the patient's situation and help her to learn ways to manage on her own. These actions paralleled the descriptions Sophia had given of physical therapy practice and clinicians who had influenced her. To Sophia practice was about supporting patients in finding their own best ways to move

and function. Her encounter with the standardized patient also demonstrated this approach to practice.

Bethany (from University A): Teamwork with the patient. Bethany demonstrated greater divergence between her characterizations of practice in her descriptions and her enactment with the standardized patient. Bethany characterized practice with a strong emphasis on the patient's psychosocial well being achieved through teamwork between the therapist and patient and others on the medical team. She described the purpose of physical therapy:

> So it's not just the physical part. I guess also the mental part… Say people with chronic pain syndrome they don't just have physical pain, they also have this perception that they're always in pain; it's not just the physical part. So you have to deal with patients' psychosocial aspect of it and also family. You have to educate the family and the patient and the caregiver… It's also about treating them as a whole.

Through her descriptions of patient interactions and her metaphor, Bethany emphasized the psychosocial role of the therapist in connecting patients to other people and meaningful life activities.

> I guess it could be a bridge. So PT as a profession connects patient to patient... And you can connect patients with their family through like education. And also how to incorporate the disability into their lives or the patient's life. And then I guess a bridge to other health care professional. As in referral.

Bethany, however, struggled to enact the patient session in the ways she had described. She opened by specifically asking the patient about her back pain. During the post-encounter interview, she reflected that a broader opening might have been more effective:

> She is here for her lower back pain, so I would like to know about her pain so I guess a better opening sentence would be "what brought you here?" So then maybe it's not the pain that's bothering her, maybe it's something else. Yeah I would like to know why she is here. Sometimes the doctor will say lower back pain and then she might be here for "Oh I hurt my ankle," or something. We want to know the patients view of her condition and see what's bothering her the most.

As Bethany progressed through the interview and examination, she focused more on identifying the patient's pathology. She kept the patient's complaint of pain in mind, but was hesitant to conduct any tests that bring on the patient's pain.

> I don't want to aggravate her; I don't want to strain her even more. Maybe I shouldn't emphasize so much on the pain, but that's her only complaint. Maybe if she has numbness and tingling and weakness, I might ask does it reproduce your complaint. But since she only talks about pain then it seems like I ask her, how's your pain, how's your pain. Just to keep her in check. Sometimes patients make faces and I can see her just making faces so I'm like okay, how are you, how's the pain. So I just to make sure I keep her in check. I'm not putting her in too much pain or hurting her.

Bethany's resistance to bringing on any pain for the patient limited her in conducting tests that would have given her more information about the pathology. She attempted to make sense of the data she had gathered but was unable to draw a clear conclusion.

> Well she has pain with almost all of her active range and motion rotation actually is not bad, it's good. But forward bending and backward bending, she is limited by pain. Forward bending, she bends her left knee so that could either be a nerve issue but she didn't say there was any numbness or tingling. She could just be not wanting to use the muscle because my first my hypothesis would be a left extensor sprain and it kind of makes sense she doesn't want to go very far because that would be eccentric lowering of her body. And then for hip extension, her abs were working because that actually puts her extensor in slack. But there's also pain so it could be… (sighs) not sure what it could be. So that's kind of where I got stuck.

Bethany attempted to keep the patient's needs and life function in focus but struggled to connect all of the pieces of her examination to make an effective assessment. Her hypotheses and reasoning strategies focused primarily on diagnosing the primary pathology and movement impairments. She also frequently drew on reasoning about the patient's personal needs. For example, she considered the patient's level of pain tolerance as she designed an intervention.

> It seems like her pain tolerance is very low. Everybody's different and I have to respect that. Once we gain trust, then they know, okay this isn't gonna hurt me, or she knows

> exactly what she's doing. Then I think it's just that having a good conversation and also letting her know, I may not know everything, but if I don't know, I'll go check. I'll find out for you and try not to hurt her. Because if I hurt her, they're not gonna come back again.

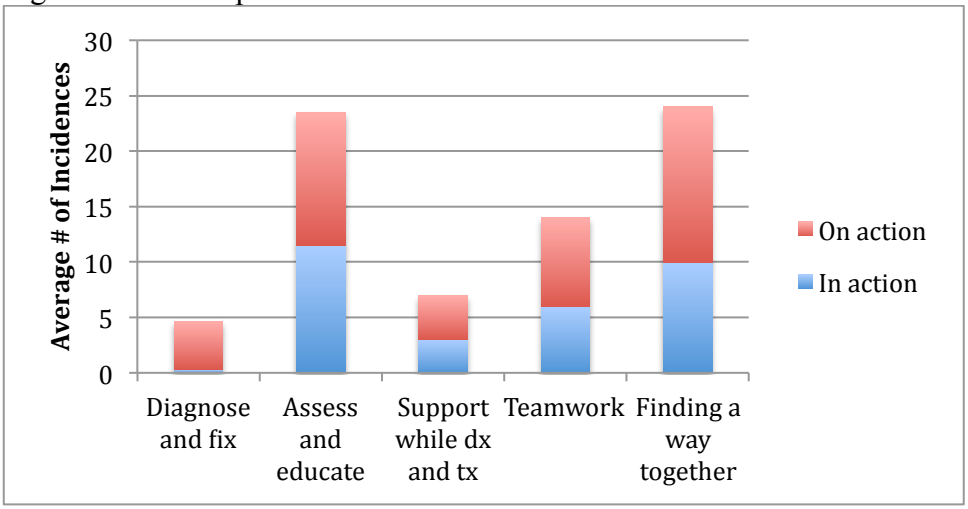
Overall, Bethany drew more extensively on trial and error during her examination than did any of the other participants. Through this trial and error and her hesitance to bring on any pain for the patient, Bethany was unable to effectively adapt her examination process to come to an appropriate assessment or fully address the patient's needs. In the discussion I present several possible explanations for Bethany's inability to carry out the patient session in ways consistent with her characterization of practice.

Use of Reflection

Students varied in the amount of reflection (both in- and on-action) that they engaged in. The three participants who indicated the greatest value on teaching and learning in the patient-PT relationship (Lisa and Hannah with assess and educate and Sophia with finding a way together) demonstrated the most incidences of reflection through their explanations of their actions during the patient encounter. At the other end of the spectrum, the three students who described physical therapy practice in terms of mechanics and problem solving and emphasized the PTs role in diagnosing and fixing problems (Peter, Mason and Kelly) demonstrated the fewest incidences of reflection during and after the standardized patient encounter. Similar to the differences in the use of reflection between experienced and novice practitioners (Wainwright et al., 2010), the students whose characterizations of practice better approximated expert practice (patient-centered and educationally focused) demonstrated greater use of reflection than those whose characterizations paralleled novice practice (practitioner-centered, focused on fixing problems). Figure 6.1 illustrates the number of incidences of reflection participants demonstrated

grouped based on their characterizations of practice. For groupings that included more than one participant, I used the average number of incidences.

Figure 6.2: Participants' use of reflection based on characterization of the encounter



Discussion

This chapter has described the relationship between students' characterizations of physical therapy practice and their enactment of practice during a standardized patient session. In this section I discuss three points from these findings that have implications for entry-level physical therapist education. First, students' interactions with the patient typically paralleled their characterizations of practice. Second, limitations in problem-solving or psychomotor skills may limit students' enactment of practice in the ways they characterize it. Third, these findings suggest that professional development in physical therapy may occur along two axes, one axis of perspective and one of skills/knowledge. Finally, each of these findings has implications for teaching and assessment in entry-level physical therapist education.

Practice Parallels Perspective

The physical therapist student's characterizations of practice gave insight into how they would approach the standardized patient encounter. Schoenfeld (2010) proposed that orientations

and beliefs influence how practitioners organize their thinking in action. Role conceptions and beliefs about practice form a framework through which professionals construct an ordered view of their practice (Clark & Peterson, 1986; Magnusson, Krajcik, & Borko, 1999; B. Richardson, 1999b; Shibutani, 1955) including assumptions of characteristic relationships and values or trustworthiness assigned to certain actions and responses (Fang, 1996; V. Richardson et al., 1991). As the human capacity for information processes is limited by constraints on short-term memory, during complex activities such as physical therapy clinical practice, individuals selectively perceive and interpret information based on their orientation to the situation (Shavelson & Stern, 1981). For healthcare practitioners, these orientations include their conceptions of the patient-practitioner relationship (Engel, 1980). These orientations influence what approaches practitioners consider legitimate in a given situation and what goals they prioritize (Schoenfeld, 2010). The variation across students in their interactions with the standardized patient paralleled the variations in their characterizations of practice described in their interviews, supporting this model that their underlying orientation to practice influenced how they approached the patient scenario. Instructors can not only gain insight into students' approaches to clinical care but also support students in developing higher levels of practice through examination of their characterizations of practice.

Perspective Alone is Insufficient

Orientations alone, however, are insufficient for students to enact effective practice. Students must also have appropriate knowledge and skills to enact the practice they envision. The case of Bethany provided an example of a student who held a highly patient-centered holistic view of practice. This perspective, however, was not entirely evident in her interactions with the standardized patient. Development of beliefs alone, will not directly lead to effective

practice, as students must have the skills to act on their beliefs. While this concept has not fully been explored in the healthcare literature, studies of professional development in teaching highlight these issues. Through a case study of one reading teacher, V. Richardson et al. (1991) suggested that a teacher's beliefs might change, while his/her practice lags behind, as the individual develops the appropriate skills to enact the new beliefs. Studies involving novice teachers support this implication that new teachers, or those trying to integrate new ideas, may lack the skills to practice as they believe to be appropriate (Brickhouse, 1990; Cohen & Ball, 1990; Tabacbnick & Zeichner, 1984). Low teaching self-efficacy and an external locus of control may also prohibit teachers from practicing in ways they believe appropriate (Thompson, 1984). Bethany exhibited many of these characteristics as she demonstrated low confidence (through her repeated inquires for assistance from a clinical instructor) during her work with the patient. Students demonstrating this type of inconsistency between their characterizations of practice and their actions may require additional support in developing their knowledge and problem solving skills in order to enact the practice they describe.

Professional Development on Two Axes

The findings presented in this chapter support Dall'Alba & Sandberg's (2006) theory that professional development can occur along two axes. Dall'Alba & Sandberg (2006) defined these axes as 1) one's understanding of practice (perspective on practice) and 2) the ability to carry out that practice. The students' in this current study demonstrated differing stages of development along both axes. Peter, Mason, and Kelly demonstrated more novice perspectives on practice through their characterizations of practice that focused on the diagnosis and treatment of medical problems (Jensen et al., 1992). They each also demonstrated adequate skill levels to address the standardized patient in ways that paralleled their perspectives, including the ability to select and

implement diagnostic tests. Sophia, on the other hand, described practice through characterizations that paralleled more experienced therapists (Jensen et al., 1992). She also demonstrated interactions and decision-making during her encounter with the patient that indicated her ability to enact her view of practice. The case of Bethany demonstrates an example of greater development along the orientations axis than the skills axis. Bethany's inability to enact the practice she described suggests that her problem-solving and decision making skills are not yet sufficient to practice in the way she characterized.

The two-axis theory of professional development may explain differential development of clinicians over time. The literature on expertise in clinical practice indicates that the development of expertise is not a function of experience alone (Resnik & Jensen, 2003). Based on the two-axis theory, clinicians or students who hold narrower (more biomedical) perspectives on practice may develop their skills in diagnosis and technical approaches to intervention, yet would be unlikely to develop the interactive skills evident in experts (Dall'Alba & Sandberg, 2006). For example, medical students' perceptions of expertise in medical practice correlated to their self-reported approaches to studying and problem solving (Mylopoulos & Regehr, 2009). Within medicine, physicians' views of practice can limit their adoption of clinical practice guidelines or models if the new ideas are not aligned with the physicians' current orientation to practice (Anderson & Funnell, 2005; Cabana et al., 1999). Further, in physical therapy practice, PTs do not integrate new knowledge into their practice structures if they do not feel that information fits within their current models of practice (Daykin & Richardson, 2004). The students in this current study who demonstrated more patient-centered perspectives on practice also exhibited greater amounts of reflection during their encounter with the patient. This differential use of reflection may have important impacts on their learning and ongoing

professional development (Shulman, 2004). To best support physical therapist students' professional development, educational programs should address both axes of professional development, supporting students' development of more holistic perspectives on practice while providing opportunities to develop the knowledge and skills necessary to enact those perspectives.

Implications for Physical Therapist Education

The interrelation of students' perspectives on practice and their enactment of practice points to the critical role of reflective practice in physical therapist education for the development of both perspectives and skills. Entry-level physical therapist educational programs must address students' developing perspectives on practice, but perspective alone is not sufficient. Students must also have opportunities to develop the skills and knowledge necessary to enact patient-centered practice. The integration of opportunities for critical reflection and practice of interactive clinical skills may support students' development of patient-centered perspectives and practice.

Reflection. Instruction in and support for critical reflection may help students develop not only more patient-centered perspectives on practice but also the skills to enact that practice. The students in this study who demonstrated the most technical/practitioner-centered perspectives on and approaches to practice also demonstrated the least use of reflection during their encounter with the standardized patient. Two possible explanations of this relationship are that 1) Students who view practice as concrete or mechanical problem solving may not value reflection as a tool to improving practice, and 2) The narrow perspective and the limited use of reflection may both be indicators of an underlying more novice ability to practice. Following from either of these hypotheses, instruction in and ongoing support for critical reflection during

both academic coursework and clinical experiences may promote these students' development of their perspectives and abilities to connect their knowledge to action in order to enact their practice.

Reflection is a crucial skill in managing uncertainty in "real world" clinical settings (Schon, 1983), but in order for students to effectively develop and integrate this practice, reflection must be addressed throughout the curriculum (Delany & Watkin, 2009). Reflective practice across classroom and clinical experiences can help students build the links they need between analytical reasoning and patient-centered care (Epstein, 1999), and transition their thinking to clinical applications (Crandall, 1993; Wainwright et al., 2010, 2011). Introducing students to a structured framework for reflection during their classroom work can provide them with support for reflection during clinical experiences (Donaghy & Morss, 2000, 2007). Specifically, the integration of intentional reflection during students' clinical experiences, through activities such as elaborating on their reasoning process with a mentor (Schmidt & Rikers, 2007), especially when students are supported in questioning their assumptions, can help students move beyond simple repetition of previously learned concepts to develop their reasoning capacities (Donaghy & Morss, 2000).

Reflection can also help students connect their classroom knowledge to the clinic. The practice of reflection during both classroom and clinical learning enables students to look back at their actions and better understand how their decisions and actions led to the outcomes they experienced (Schon, 1987). Further, without the capacity for reflection, students will be limited in their ability to learn from experience, as it is not the experience itself that promotes learning but the process of thinking about the experience (Hayward et al., 2013; Shulman, 2004). Reflection before, during, and after learning activities can better promote students'

metacognition in reasoning (Higgs, 1993). Specifically designated time during clinical experiences for reflection may help students better develop their experiential knowledge, the type of knowledge clinicians depend on most (Jensen & Paschal, 2000; B. Richardson, 1999a). The type of self-assessment that students can develop through reflection is crucial for helping students identify their own strengths and limitations and engage in ongoing professional development (Donaghy & Morss, 2007). Reflection may be the key to helping reduce the mismatch between classroom education and the type of knowledge needed for clinical practice (Donaghy & Morss, 2007; Jensen & Paschal, 2000; B. Richardson, 1999a). These reflective skills may also enable students to develop more holistic perspectives on practice and the ability to further learn from practice

Broader development of clinical skills. The types of knowledge and skills emphasized within entry-level physical therapist educational programs can also influence students' perspectives and abilities to practice. Programs typically emphasize the development of knowledge and technical skills, yet attention to both orientations and skills may better support students in developing the habits of mind and skills necessary to take a trajectory towards expertise (Jensen & Paschal, 2000). Factors in curricular design may impact students' development of patient-centered orientations to practice alongside the skills necessary to enact that approach to practice.

Learning experiences that emphasize the importance of communication skills and caring alongside technical abilities may support students in developing the abilities to enact more patient-centered approaches to practice. The integration of a community of practice and reflective practice may support students in cultivating caring approach to practice and the skills to enact that practice (Hayward & Li, 2014). Research in a variety of professions suggests that

including conversational routines within professional education can enhance practitioners' abilities to enact effective interactions within their practice (Ball & Forzani, 2009; Holmstrom & Rosenqvist, 2001; Lampert, Beasley, Ghousseini, Kazemi, & Franke, 2010). Studies of PT students' development of communication and interpersonal skills suggest that reflection and dialogue, in addition to observation and practice, are critical learning strategies for the development of effective interpersonal interactions with patients (Plack, 2006). Including opportunities for students to develop conversational skills for collaborative reasoning and providing opportunities for ongoing reflection and dialogue may support students in developing a more patient-centered orientation to practice and the skills for patient care (Hayward, Blackmer, & Markowski, 2006; Plack, 2006). Effective communications skills are necessary for healthcare practitioners to navigate the contextual obstacles to patient-centered practice (Taylor, 2009); thus development of an orientation to patient-centered practice and the communication skills to enact it are critical elements of physical therapist professional development.

Conclusion

The findings in this chapter support the model that students' approaches to clinical reasoning and decision-making follow from their perspectives on physical therapy practice. The qualities students' emphasized in their descriptions of physical therapy practice were evident in their interactions with the standardized patient. As the case of Bethany demonstrates, however, the development of perspective alone is insufficient; students must also develop the skills necessary to enact the practice they envision. Entry-level physical therapist educational programs should include learning opportunities that support students in developing a patient centered perspective on practice and the skills to carry out that practice. The next chapter examines how

program level factors may influence students' development of both their perspectives and skills for practice.

Chapter 7

Variations by Program

Contextual and program factors influence student learning (Huhn et al., 2013; Newble & Entwistle, 1986; Sadlo & Richardson, 2003). Thus, students' approaches to clinical reasoning may be related to their educational program experiences. Factors across the curriculum likely influence students reasoning, as a single class in reasoning processes is insufficient to teach students how to reason and integrate knowledge (Burnett & Pierson, 1988; Higgs & Boud, 1991). Currently, there is no standard model for physical therapy education in the United States (Gordon, 2011). One aspect of curricular structure that may significantly impact students' clinical reasoning is the timing and placement of clinical affiliations. Within the two primary curricular models for clinical affiliations (integrated and terminal) (American Council of Academic Physical Therapy, 2014), integrated clinical experiences may provide students with greater opportunities to explore the concepts they learn in their courses (Huhn et al., 2013). If programmatic factors influence students' development of clinical reasoning, then students at different entry-level physical therapist educational programs would demonstrate differences in their clinical reasoning approaches and skill. In this study, University A employed a terminal clinical curriculum, while University B employed an integrated curriculum. No studies to date have examined the qualitative differences in students' development of clinical reasoning skills at different programs.

Findings

In this section I describe the similarities and differences across programs in the students' characterizations of practice and approaches to the patient encounter. I begin by describing within and across program patterns in students' characterizations of practice. I then describe the

similarities and differences across programs in students' actions during the patient encounter. Finally, I describe patterns in the factors students cited as impacting their views on practice and clinical reasoning processes.

Characterizations of Practice

Students in both programs characterized physical therapy practice in ways that indicate their development as novice physical therapists. First, through their clinical examples and Q-sort rankings, students at both programs described the role of the physical therapist in addressing patients' movement for functional purposes. Specifically all students included at least one of the following in their top rankings in the Q-sort: functional status, activity testing, or employment and leisure activities. All students, regardless of program, also described the role of physical therapy in addressing movement impairments and activity limitations. The students' emphasis on addressing movement for functional purposes indicates their development of one of the key elements of physical therapy practice: analysis of and support for the patients' movement (Embrey et al., 1996; S. May et al., 2008; Riolo, 1996). Within this focus on movement, students at both programs described practice from a perspective consistent with novice practice (Jensen et al., 1990). Specifically, these students emphasized the technical/mechanical aspects of physical therapy practice, focusing on making a diagnosis and treating the patient's problems (Jensen et al., 2000). This characterization, evident in some students at each program, is consistent with typical novice practice focused on the application of technical skills (Jensen et al., 1992). Students at both programs also used patient-centered language in many of their explanations. While half of the students at each program appropriately used this language, half of the students at each program demonstrated misapplications of patient-centered language, including issues such conflating active-participation with compliance. This use and misuse of patient-centered

language suggests that students at both programs had exposure to the language but may have lacked sufficient experiences to gain a deep understanding of the practice in action (Cohen & Ball, 1990).

In addition to the typical novice conceptions of practice evident at both programs, students at each program demonstrated elements of more complex understandings of practice, yet these manifested in different ways at the two programs. At University A, half of the students strongly emphasized the role for physical therapy in the patient's psychosocial well being. At University B, three of the four students highlighted the physical therapist's responsibilities as an educator, a quality not evident in the students at University A's characterizations. These three students also placed the patient's expectations for therapy in their most important list in the Q-sort, while all participants at University A placed the patient's expectations in their least important list. Each of these elements (the psychological and the educational) is a component of expert practice (Jensen et al., 2000), yet the presence of one element at each program suggests that different qualities of practice may have been highlighted in each program.

Actions During Patient Encounter

During the encounter with the standardized patient, students also demonstrated many similarities across programs. All students, regardless of program, began the patient encounter with an interview and transitioned to examination/tests/measures. During the interview all participants sought information about the patient's description of her chief complaint, the patient's goals for therapy, and the details of the patient's pain, including aggravating and easing factors, pain ratings and pain location. Most, but not all (at least 3 of 4 at each program), participants elicited information about the patient's employment and recreational interests, and past and current medical history. During the examination all students at both programs also

included tests and measures aimed at identifying the patient's pathology and biomechanical or structural links to the pathology. These tests included assessing posture and active range of motion (AROM) of the spine, palpating the painful region, and conducting special tests aimed at identifying affected tissues. All of these interview questions and tests and measures are consistent with elements of the physical therapy examination process (American Physical Therapy Association, 2003). Following their examinations of the patient, all participants at both programs included identification of a pathology (medical diagnosis) in their final assessment. Students at both programs also made similar reasoning errors. For example, one participant at each program prematurely focused in on a muscle strain and took a narrow approach to the examination, similar to Croskerry's (2003) description of Confirmation Bias and Premature Closure. These participants failed to generate a sacroiliac joint hypothesis, never conducted any sacroiliac joint tests, and focused in on muscle strain. Overall, all participants at both programs conducted the patient encounter in a similar pattern, including interviewing the patient, then conducting tests/measures, then forming an assessment, and finally proceeding with an intervention. This aspect of the students' actions follows from the typical patterns of interview-then-examination noted in many clinical reasoning frameworks (Rothstein et al., 2003).

Within the general framework of the patient encounter, students from the two programs demonstrated six primary differences in their approaches to the patient. First, participants differed on the priority they gave to imaging (x-ray or MRI) tests. All participants at University A inquired about whether the patient had had imaging tests, and determined that they would want the patient to return to the physician for x-rays when they learned none had been taken. None of the participants from University B inquired about imaging tests. Second, the students from the two programs differed in how they responded to the patient's disclosure of her Type II Diabetes.

At University A, participants inquired if she took medication and then asked no further questions when they learned that she did not. At University B, upon learning that the patient did not take medication for the diabetes, the participants asked further follow up questions regarding her management of the diabetes. These students' flexibility in following up on the patient's response rather than moving along on a checklist suggests higher levels of understanding of the patient interview process (Jensen et al., 1992; Rothstein et al., 2003). Third, students demonstrated consistent differences in their willingness to have the patient move into painful positions during the examination. At University A, students repeatedly advised the patient to not move to the point of pain. Mason explained why he asked the patient to stop her movement short of the onset of pain.

> Because that could flare the patient up and if the patient gets flared up, then the rest of my test is going to be difficult, I have to sometimes remind, even like in my past experience a lot of patients have the idea that oh pain is good or no it's supposed to hurt they're doing the exam, we don't want that though, we don't want to bring them into pain to hurt them to make it worse cause that doesn't do them any service and we are actually limited in our treatment when they're more flared up, so that constant reminder kind of has to be there.

Kelly further explained that asking the patient to stop short of pain was emphasized in their orthopedics course. At University B, the students consistently explained to the patient that some of their tests could cause an increase in her pain. For example, Sophia explained to the patient prior to asking her to perform a forward bend,

> I'm going to have you move a little bit. I'm actually going to try to see what's painful for you so it might increase your pain. I want it not to be a severe pain though, okay?

The students from University B indicated that explaining the patient that he/she may have to move into some painful positions was something they had learned in their orthopedics courses. Fourth, while all students asked the patient to perform active range of motion flexion and extension, they differed in how they interpreted their findings. The students at University A used

their observations and the patient's responses to assess pain onset and to hypothesize about tissue involvement (i.e.: muscle strain, facet joint, disc). For example, Mason explained his thinking after observing the patient's active range of motion in flexion and extension: "So if she's limited in one versus the other, it could point me towards structures, muscles, or certain joints, if it's something in the spine, if it's something more on the lateral side, whatever it may be." This focus on pain provocation and location as indicators of pathology suggests these students are following a biomedical model in their reasoning about the patient's pain (S. May et al., 2008). At University B, three of the four participants used their observations of the patient's active range of motion to form hypotheses about the patient's movement behaviors and patterns. For example, Lisa described a different thought process after observing the same motions as Mason had. She explained,

> So I wanted to see how willing she was to move for one thing. Not very willing to move. Very cautious with bending forward, which is always an interesting thing with somebody who says they are crouching things to pick up pots and pans from underneath. And then you ask them to do a forward bend, "oh it hurts". Okay, well you're grunting through it throughout the day, so to me you're probably pushing through a pain a little bit too much throughout your day.

Similar to Lisa, other students from University B also described a process of assessing the patient's movement patterns and behavioral choices in response to their observations of active range of motion. These students demonstrated a more integrated approach to movement analysis, looking beyond isolated impairments to patterns of movement and behavior (McGinnis et al., 2009). Fifth, the students from the two programs demonstrated consistent differences in how they prioritized the data they collected for making a sacroiliac joint diagnosis. At both programs, three of the four participants conducted multiple tests for sacroiliac joint dysfunction, including provocation tests and alignment tests. All of the students at University A based their final assessments on the results of the sacroiliac joint provocation tests. They explained that in

their orthopedics class they had learned that the research evidence suggested that one needed positive findings on three of five sacroiliac joint tests in order to make the diagnosis. These students' justification of their diagnostic process is consistent with the literature on sacroiliac dysfunction (Dreyfuss et al., 1994; Walker, 1992). At University B, the students also conducted both the provocation tests and alignment tests but biased their decisions towards the alignment tests. When they found that the patient had apparently normal pelvic alignment, even though she had positive sacroiliac joint provocation tests, these students ruled-out sacroiliac joint dysfunction. The students from University B also indicated that they had learned that process from their orthopedics class. Two students also indicated that the process of prioritizing pelvic alignment over the provocation tests had been reinforced in their clinical affiliations. Both these students' and their clinical instructors' reliance on information from courses or colleagues over the research evidence for assessment and intervention parallels the broader use of evidence based practice in physical therapists. While most PTs indicate that they value evidence-based practice, most PTs do not consistently integrate research evidence into their practice (Iles & Davidson, 2006; D. U. Jette et al., 2003; Turner & Whitfield, 1997). Finally, the students from the two programs differed in what they prioritized in their treatment plans. Three of the four participants from University A placed the highest priority on pain management. Bethany described her reasoning for prioritizing pain management in her treatment program.

> Decrease pain because pain is so limiting. Pain limits her from doing anything. So she says sitting is better, which is good but she works so much and for her to return to work like say 8 hours, I think pain management is a big part. Her active movement and everything, I think she can get by – I think pain is the culprit, and I want her to rest too, but if she's not able to then.

The students from University B, on the other hand, prioritized patient education and self-management. Sophia explained her reasoning for prioritizing patient education.

> Definitely her patient education. So that she has follow through when doing the activities. Telling her why this is beneficial. And then also, as well with what patient education goes, continuing to move instead of stopping altogether. I've seen patients who hurt their back and then they stop moving and it's five months down the road and they can barely move anymore. That's the worst thing you could have done for yourself.

The students at University B's emphasis on patient education in their treatment programs paralleled the emphasis they placed on education in their characterizations of practice. This focus on education over direct treatment suggests these students are demonstrating progress towards the practice characteristics of experienced clinicians with the emphasis on education over hands on treatment (Jensen et al., 1992). These programmatic differences suggest that while students at both programs learn the same general process for conducting a patient examination, they differed in how they learned to interpret and act on the data they collected.

Influences

The students from the two programs described three similar factors that influenced their perspectives on physical therapy and their actions during the patient encounter. First, students at both programs cited personal experience with physical therapy as an influence on their understanding of practice. These personal experiences ranged from impacting their understanding of the basic procedures in physical therapy to the necessity for creativity. For example, Peter explained that his experience as a patient in physical therapy initially led him to believe that physical therapy was a straightforward application of procedures.

> I had therapy done on my knee for tendonitis, and that was before I had gone to physical therapy school and honestly I thought at that point that it would be easy, you know just give them a few exercises, so I was probably 19 or 20 at the time, so that may have shaped my idea of physical therapy.

Chloe, on the other hand, cited personal experiences as impacting her understanding of the creativity required in physical therapy. She described her observations of her father's physical therapy for Parkinson's disease.

> So my dad has Parkinson's and he is getting into more of the dementia stage, so he's actually not doing much PT anymore, but when I was able to sit in on one of his PT experiences and I just thought it was amazing because the PT really had him engaged and they really made it fun for him, so not only were they doing boxing with him, they were throwing balls, doing the big arms, big everything, then they actually took a Nerf gun and had him shooting one of the aids and the aids was hopping around, so I thought that was pretty poignant in what I want to do with my patients and make it fun, and not just pumping iron, doing reps, doing things like that, I want to be able to make it fun for them and to gain that function back.

Each student described some type of personal experience that influenced his/her perspective on physical therapy. Some students, such as Hannah, indicated that later coursework deepened their understanding of the complexity of physical therapy, while others such as Chloe considered the complexity from their early experiences. Second, students at both programs indicated that their didactic course work helped them to understand the breadth and complexity of physical therapy practice. Students such as Peter and Mason explained that the vast quantity of information they were exposed to during their initial coursework influenced their understanding of how much knowledge is required to effectively assess and treat a patient. As Peter explained,

> My coursework, just seeing how involved it is, and how much of the knowledge you need in order to treat patients appropriately. I don't think many people know how much goes into treating a patient. I think you think you just read it in a book and go off a template and you can treat a patient, but I think through the coursework, it's a lot more than that.

Chloe further explained that coursework had influenced her to think more deeply about underlying factors. She explained that her orthopedics instructor frequently reminded the students, "They've really kind of nailed it into us that low back pain is ninety percent of what you're going to see in the clinics. They kind of think, 'Well, don't just think about low back because it might be coming from somewhere else.'" Finally, students from both programs described their clinical experiences as reinforcing or bringing greater understanding to skills or procedures they had learned in class. Mason explained that his clinical affiliation gave him the opportunity for greater amounts of repetition necessary to master the procedures.

> When you're in the clinic and you're seeing 15 patients a day, you're gonna do that 15 times and you become very methodical about it, when you're in school you're still kind of learning that base of knowledge that's important for the clinicals, so they both kind of influenced me and as I go further in my didactic education, I feel like I get better at my clinical knowledge, but it's not fine-tuned.

Hannah indicated that her clinical experience helped her to better understand the principles underlying the tests she had learned in class. She explained how her understanding and use of specific sacroiliac joint tests had been impacted.

> I saw, I've seen it in class uhm, just as we were doing SI joint just to reset and I saw my CI do it. So at first in class, I didn't understand why but then I was like oh because you shift and everything so seeing it in the clinic, I was like okay so it is a thing, it does make it, it does help so uhm both for sure class when we did SI.

This interaction of classroom and clinical learning that the students described indicates the importance of consistency between classroom and clinical education for effective development of clinical reasoning. The literature suggests that current entry-level physical therapist educational program structure fails to fully realize the connections between classroom and clinical learning (Jensen & Paschal, 2000; B. Richardson, 1999a). Students from both programs indicated that personal experience, physical therapy didactic course work, and clinical affiliations influenced their views on physical therapy practice and their actions during the patient encounter. The timing and organization of the classroom learning and clinical affiliations, however, may impact their influence on students' learning as the program differences described in the next section suggest.

The primary differences between the two programs in this study are the timing and quantity of clinical affiliations the students had completed at the time of the study. At University A, students had completed one six-week clinical affiliation at the end of their first year of course work and one on-campus integrated (one patient per week) clinical experience during the final term of their second year. At University B, the students had completed 16-20 weeks of clinical

affiliations. They completed two weeks during the final trimester of their first year, two weeks during the first trimester of their second year, and 12-16 weeks during the second trimester of their second year. The three differences in influences that the students cited as impacting their understanding of physical therapy practice and their actions during the patient encounter likely stem from these differences in program structure. First, in their descriptions of experiences that had influenced their perspectives on physical therapy practice, all participants from University A cited experiences that impacted their understanding of physical therapy focused on carrying out procedures, while only one participant at University B. For example, Bethany identified the impact of her work as an aide on her understanding of the different types of tools and skills at physical therapist could use.

> PTs that came out recently within the last 5 years and also PTs that are way back. So that gave me a little different approach to treating patients. B/c I think that back in the day, they treat more manual, they use their hands and thumbs and use their body a lot whereas the PTs now they use Graston tools, which is like the butter knife and also a lot of other stuff that can preserve your body and let you work longer without pain.

The consistent identification of experiences that influenced their understanding of physical therapy focused on procedures suggests a more mechanical perspective on practice from the students at University A. Second, consistent with the difference in amount of clinical affiliations in the programs, students at University A cited their pre-physical therapy volunteer and aide experiences most frequently as impacting their perspectives on physical therapy practice while no student from University B did. The students from University B, on the other hand, consistently cited their clinical affiliations within their program, and two participants described the impact of specific patients they worked with during those affiliations. Finally, the students at the two programs described different impacts for their coursework on their actions during the patient encounter. The students from University A consistently cited their orthopedics

coursework and specific procedures, protocols, and decision making guides they had learned in their coursework as influencing their interactions with the patient and the conclusions they drew from the information they collected. Following her work with the patient, Chloe explained how her coursework had impacted her process during the patient encounter.

> Mostly ortho classes have been really amazing with Dr. B and just going through it and getting the most hands on experience and they've really kind of nailed it into us that low back pain is ninety percent of what you're going to see in the clinics. They kind of think, "Well don't just think about low back because it might be coming from somewhere else."

The students from University B, on the other hand, cited their coursework together with their clinical affiliations. Typically, they described their clinical affiliations as helping them to better understand the procedures they had learned in class or supporting their development of more flexibility in using the procedures. For example, Lisa explained how her clinical affiliations influenced her to have more flexibility in her examination procedures.

> Clinically, in terms of whenever I get a person onto the table and trying to decide how much I'm going to move them around, that's more clinical. I think when we're in the test; we're working with somebody that is healthy. In the practical, the person is pretty healthy, usually and we can ask them to jump up and down and do backflips and they're usually okay, but you get into the clinic and you have somebody that goes from sideline to supine and that takes them 5 minutes just to do that. And you're like okay I really need to get better.

Overall, the students from University A cited experiences prior to physical therapy school and their didactic coursework more frequently than the students at University B did. The students at University B indicated that their clinical affiliations had influenced both their perspectives on physical therapy practice and their actions and reasoning processes during the patient encounter. These differences point to the impact of the timing and quantity of clinical experiences in influencing both students' perspectives on practice and clinical decision-making.

Discussion

The differences described in this chapter suggest that variations in programmatic factors likely influence PT students' characterizations of practice and clinical decision-making. The similarities in the students' approaches to the patient encounter suggest a baseline consistency across the programs, yet different aspects of practice may be highlighted, emphasized, or prioritized at each program. The difference in timing and quantity of clinical experiences likely plays a role in the differences in the students' practice, yet other program elements may also influence the students' perspectives and practice.

In this section, I first discuss how the findings in this chapter raise an important question over the impact of clinical experiences versus classroom teachings and the timing of the two. I then examine two factors: 1) values modeled by the faculty and 2) the timing of clinical experiences that may contribute to program-wide differences in students characterizations of practice and clinical reasoning. Finally, I propose future directions for research to better investigate the programmatic elements that impact students' clinical reasoning.

Impacts of Clinical versus Classroom Learning

The programmatic differences in the students' characterizations practice and clinical decision-making during the patient encounter suggest program level factors may be influencing both students' perspectives and clinical reasoning. At University B, students placed a higher value on the physical therapist's role as an educator both in their descriptions of practice and through their actions with the patient. These students tended to attribute their choices to influences from both their classes and clinical experiences. From the data in this study, it is impossible to determine if this difference in value placed on teaching stems from the greater amount of clinical experience or from practices valued within the didactic curriculum at

University B. Two of the differences in the students' clinical decision making point to the impact of classroom teachings: 1) how to manage pain onset in clinic; 2) evidence based or clinical anecdotes for diagnostic criteria. As they explained their reasoning following the patient encounter, students from both programs directly linked their justification for these two aspects of the examination to what they had learned in their orthopedic coursework. The students at University B, however, indicated their clinical experiences reinforced the practices regarding pain onset and sacroiliac diagnosis that they had learned in their classes. The students at University A who described learning an evidence-based approach to sacroiliac joint diagnosis, did not mention clinical experience as impacting their understanding of this practice, and emphasized the role of their orthopedics course in influencing their reasoning. These patterns suggest the interaction of classroom and clinical learning, in that as students gain more clinical experience, certain practices that they learned in the classroom may be reinforced. An interesting question these findings raise is whether or not the students from University A will continue their evidence-based approach to sacroiliac joint diagnosis if they encounter non-evidence-based practices during their later clinical affiliations.

Programmatic Factors That May Influence Clinical Reasoning

Faculty Values and Behaviors. The values and behaviors modeled by the faculty and administrators during on campus didactic coursework may contribute to the observed differences in students' characterizations and enactment of practice. These values and ideas may be communicated explicitly or implicitly. For example, the students in this study demonstrated differences in their approach to pain management during the patient encounter and diagnostic criteria for SIJ. They described explicit teachings in their programs communicating these ideas. Other differences, such as the difference in focus on teaching by students at University A

compared to psychological/emotional processes by students at University B, may be communicated more indirectly.

Faculty within an educational program model not only technical skills but also values and priorities. These values are communicated through the behaviors of the faculty as a whole, not at an individual course level, as it is the aggregate influence of the faculty's implicit professional behaviors that determines what skills and values students develop (Santasier & Plack, 2007; Threlkeld, Jensen, & Royeen, 1999). The representations of practice (the examples of practice enacted within the educational program) influence what students learn to see from the disciplinary perspective (Grossman et al., 2009). For example, programs that emphasize students' technical skills and scientific knowledge over individual patient needs may sway students away from a patient-centered perspective (Kieser et al., 2009; Shepard & Jensen, 2002). Overall, the teaching and policies within a department exert a strong influence on students' approaches to learning and their conceptions of knowledge (Newble & Entwistle, 1986; Sheppard & Gilbert, 1991). Differences in teaching practices or departmental policies between programs may contribute to differences in students' perspectives on practice and clinical decision-making. In order to truly study these programmatic differences, however, one would need direct observations and interviews with faculty and students. An analysis of course descriptions or even syllabi would likely not reveal the types of implicit messages that may be communicated through classroom teaching and assessment.

Timing of Clinical Experiences. The timing and amount of clinical experience that the program offers may further contribute to the observed differences in the students' characterizations of practice and clinical decision-making at the two programs. All students mentioned their clinical affiliations as affecting how they thought about physical therapy

practice. The students at University B (with an integrated clinical curriculum) had 10-14 weeks more offsite clinical experiences than the students at University A (with a terminal clinical curriculum). The students at University B also had their clinical experiences starting with semester 3 (first-year). The students at University A had a 6-week clinical experience following their first-year and then completed a one-semester on campus one patient per week on campus clinical. The students at the two programs demonstrated differences in their approaches to and interactions with the patient (as described in the findings above). Prior research has suggested timing and volume of clinical experiences in the program may impact students' critical thinking scores (Huhn et al., 2013).

The difference in the amount of direct clinical experience the two programs offer may influence how students develop their conceptions of practice. Early clinical experiences, even experiences that include only observation, can help students in developing their conceptual models of PT practice and reasoning (Collins, Brown, & Newman, 1987). The development of these conceptual models can influence students' later classroom learning, as students need a clear conceptual model of the entire task in order to understand a portion they may be focusing on (Collins, 2006). Clinical experiences included throughout the curriculum would enhance teachers' abilities to situate the task of clinical reasoning and provide varied examples in practice (Collins, Brown, & Holum, 1991), better promoting students' understanding of the contextualized nature of clinical reasoning (Charlin, Boshuizen, Custers, & Feltovich, 2007; Jones, 1992). Beyond supporting students' knowledge organization, clinical experiences can help students understand the nature of clinical knowledge as a dynamic resource, not simply a collection of examples (Mylopoulos & Regehr, 2007). Finally, clinical experiences can support students in developing contextually appropriate interactional skills, an affordance not present in

the classroom setting (Benner, 2004). The findings from this current study suggest that timing of clinical experiences may impact students' approaches to the patient encounter; however, greater analyses of the programs and clinical experiences are necessary to draw firm conclusions on this influence.

Need for Further Research

This dissertation has described differences in students' characterizations of practice, clinical decisions and reasoning strategies between two entry-level physical therapist educational programs. At a macro-level, the two programs differ primarily based on the timing and volume of the clinical affiliations the students had participated in by the end of their second academic year (integrated versus terminal clinical curricula). Many other programmatic factors, beyond the timing of clinical experiences may also contribute to the observed differences in the students reasoning and decision-making. The current data does not allow for analysis of which programmatic factors influenced the differences in students' characterizations and practices at the two programs. Interviews with faculty and administrators and classroom observations would be necessary to effectively assess how faculty and administrator values are communicated. Further, assessment of students' characterizations of practice and actions during clinical encounters longitudinally throughout their education may provide critical information regarding changes affected by specific program elements such as a first clinical affiliation or a specific course. Detailed observations of faculty and students' use of language (patient-centered and otherwise) in classroom and teaching laboratories may provide more insights into the students' appropriation of patient-centered and technical language. This chapter has provided some preliminary insights into differences in students' characterizations of practice and clinical decision-making that occur at a program level, yet far more research is needed to understand

what programmatic factors contribute to these differences. A greater understanding of the program level factors that impact students' characterizations of practice and clinical reasoning can allow programs to make curricular decisions that best support students' development of effective patient-centered clinical reasoning.

Chapter 8

Conclusion, Implications, and Limitations

In this dissertation I have examined eight physical therapist students' characterizations of practice, as well as their clinical reasoning and decision-making during a patient encounter. Students in two different programs demonstrated characterizations of and approaches to practice that ranged from practice characteristic of typical novice clinicians to that of more experienced practitioners. Students also demonstrated consistency among their characterizations of practice, their reasoning processes, and their actions during the patient encounter. Although the students overall demonstrated a high level of similarity, I identified six key differences between the clinical reasoning processes of students from the two programs.

The theoretical framework for this dissertation was based on a model of four capacities required for patient-centered clinical reasoning. In this final chapter, I first build on the findings from each of the previous chapters to refine the model, specifically indicating the inter-relations among the capacities as a student engages in clinical reasoning. Then, drawing together the educational implications from each prior chapter, I propose three over-arching principles that should guide entry-level physical therapist educational curricular design.

Revised Model of Clinical Reasoning

In the theoretical framework, I proposed that four capacities underlie clinicians' abilities to engage in physical therapy specific patient-centered clinical reasoning. These capacities are: 1) a well-organized knowledge base and content-specific deductive reasoning skills (Higgs, 1992), 2) the ability to effectively interact with patients (Hayward et al., 2013; Higgs, 1992), 3) the ability to manage decision making in a context of uncertainty (Hayward et al., 2013; Shepard & Jensen, 1990), and 4) a patient-centered, biopsychosocial orientation to practice (Schoenfeld,

2010; Trede & Higgs, 2008). The findings from this dissertation study supported the importance of these four capacities. Not only has this research supported the necessity of these capacities, it has illustrated some key inter-relations, specifically between the nature of a student's understanding of practice and his/her clinical decision making and use of reflection. The next section describes the role of each capacity as evidenced by this study, and the following section proposes a revision to the initial model based on the findings from this dissertation study and current theories of practice.

Figure 8.1: Capacities required for clinical reasoning

Support for Constructs in the Preliminary Model

Reflection. Participants' use of reflection influenced their reasoning processes during the patient encounter and their views on practice. The students who demonstrated greater use of reflection in-action during the patient encounter demonstrated more flexible reasoning processes,

while those who demonstrated the least engaged in the most "linear" rule-driven approach to reasoning that is typically evident in novices (Conger & Mezza, 1996; Jensen et al., 1992). Following the patient-encounter, seven of the eight participants integrated information gained from prior clinical experiences into their work with the patient through reflection-on-action. Reflection on-action from clinical experiences also influenced the students' characterizations of practice. Overall, the findings from this study indicate important roles for reflection during immediate clinical decision-making and for students' development of clinical reasoning abilities.

Content specific reasoning. Participants' abilities to draw on content specific knowledge impacted their abilities to enact their desired actions with the patient. During the immediate patient encounter, a participant's ability to draw on and organize content specific knowledge impacted his/her ability to effectively form an assessment and develop an intervention. For example, Mason failed to generate a hypothesis about sacroiliac joint dysfunction during the patient encounter yet reflected after the session that he should have taken that diagnosis into consideration. His inability to draw on the knowledge in action suggests it was the accessibility or organization of knowledge (not a lack of knowledge) that limited his ability to form a specific hypothesis.

Orientations and content specific reasoning. Each student's characterization (model) of practice was represented in his/her approach to the patient-encounter such that the qualities the student highlighted in his/her descriptions of practice were evident in his/her actions with the patient. For example, Lisa, who repeatedly described the physical therapist's role as a movement educator, focused her work with the patient on identifying movement patterns and educating the patient on biomechanical and behavioral changes. Kelly, on the other hand, framed the patient problem around diagnosing and fixing problems and consistently drew on her knowledge of

procedures for identifying an appropriate pathology. The case of Bethany, as described in chapter 6, demonstrated an example of how a student's content specific reasoning limitations impacted her ability to engage in the type of problem solving she had envisioned through her characterizations of practice. Overall, the students' abilities to access, organize, and draw on content specific knowledge impacted their abilities to interact with the patient as they had characterized.

Interactions. The single visit standardized patient model provided limited insights into the students capacities for interaction. All students primarily focused on gathering information (through questions or tests/measures) from the patient.

The four capacities were evident throughout the students' clinical decision making with the patient. In the following, section I present a model that accounts for the interrelations of the capacities described above.

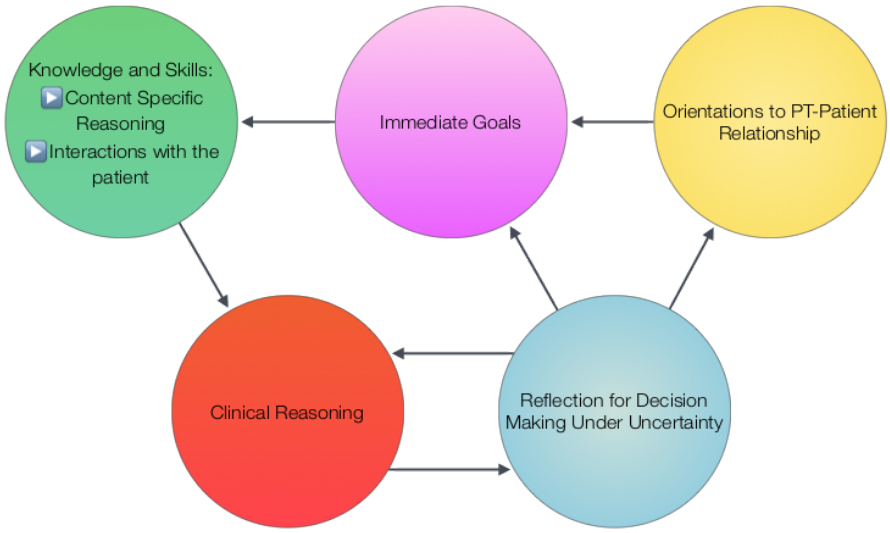
Proposed Integrated Model

The previous section demonstrated how the findings of this dissertation study supported the roles of the proposed four capacities for clinical reasoning and their interrelations. The ensuing sections propose a revised model that accounts for the interactions between the capacities. The findings from this dissertation uphold the role of a student's orientation to practice as a critical influence on his/her clinical reasoning and decision-making with a patient. In his work with teachers, Schoenfeld (2010) addressed the relationship between a professional's orientation to practice and his/her moment-to-moment actions. Schoenfeld proposed that one's immediate goals (what the individual wants to accomplish in the moment) drive his/her utilization of resources (knowledge, skills, and material and social supports) during skilled

decision-making and action. These goals are set consistent with one's system of beliefs and prioritized based on the value assigned to the specific outcome (Schoenfeld, 1998).

The revised model builds on the initial model by providing illustration of how the four capacities work together as students engage in clinical reasoning. First, the revised model indicates that students draw on their abilities for both content specific reasoning and patient interactions as they engage in clinical reasoning. Second, the revised model introduces the role of immediate goals as a link between students' orientations to PT-patient relationship and their use of knowledge and skills for reasoning and action. Third, the revised model demonstrates the role of reflection in managing uncertainty in both the immediate clinical reasoning process and in the development of orientations. Finally, the structure of the revised model indicates how all of these capacities work together. Figure 8.2 illustrates the revised model.

Figure 8.2: Revised model of clinical reasoning



Students' orientations to practice influence the types of immediate goals they form. The students' immediate goals then drive the knowledge and skills they draw on in order to engage in clinical reasoning and decision-making. As they engage in clinical reasoning and decision-making, their ability to reflect in- and on-action impacts their ability to modify their reasoning

processes and actions in an uncertain context. Reflection in-action may lead to modification of immediate goals that lead to revised actions and decisions. Over the long term, reflection on-action may also lead students to revise and adapt their orientations to practice.

The following sections describe in more detail how the findings from this dissertation study support the revised model. I first describe types of immediate goals students form during encounters with patients. I then describe the role of these immediate goals as a link between students' orientations to practice and their use of knowledge and skills (content specific reasoning and interactional skills) to engage in clinical reasoning. Finally, I describe how the findings support the role of reflection during both immediate action and long-term development of orientations.

Types of Immediate Goals

In the previous, section I explained the inter-relations between the students' orientations to practice, their abilities to draw on knowledge and skills, and the role of reflection in mediating their actions. In the following section, I describe the role that immediate goals play in linking a student's orientations to his/her actions. As Schoenfeld (2010) described, immediate goals drive action, and these goals are prioritized based on one's orientation to practice. These goals at times may be explicitly identified (such as wanting to identify pathology, manage pain, or educate the patient), but also act more implicitly during moment-to-moment actions, specifically driving how problems are framed.

Goals during patient examination. The students did not explicitly state step-by-step goals during their patient examination and assessment processes. However, the hypotheses they formed and the reasoning strategies they drew upon as they selected the tests and measures indicated their implicit goals. For example, the majority of Kelly's reasoning strategies focused

on diagnostic reasoning about the primary pathology. Her selection of tests and measures also focused primarily on special tests aimed at ruling in or ruling out a specific pathology. Her actions and reasoning strategies during the patient-encounter point to her goal of diagnosing a specific pathology. Sophia, on the other hand, more frequently used reasoning strategies focused on identifying the patient's personal needs and movement impairments. The use of these reasoning strategies combined with her formation of multiple hypotheses about the patient's behavioral characteristics point to Sophia's immediate goals during the examination as identifying the patient's movement and behavioral patterns.

Goals for intervention. The students made their goals more explicit when they described their plans for intervention, yet these goals also demonstrated consistency with the implicit goals they had pursued during the patient examination. For example, Mason explicitly identified pain management as his goal for the patient's treatment. He then selected a treatment (soft tissue mobilization) that was consistent with his stated goal for the treatment. Lisa identified patient education and self-management as her goals for treatment. She also selected interventions consistent with this goal as she focused on teaching the patient appropriate movement strategies. Lisa's examination process (while not explicitly stated) was also consistent with these goals as she focused on understanding the patient's movement patterns and personal characteristics.

Goals as the Link Between Orientations and Use of Knowledge and Skills for Reasoning

Goals and orientations. Not only did the students' explicitly and implicitly identified goals drive their examinations, assessments, and treatments, but these goals also directly related to their characterizations of practice. For example, Mason had described practice in terms of fixing mechanical problems, and his implicitly identified goals (represented by his reasoning strategies) during the examination also focused on diagnosis of the primary pathology and

reasoning about procedures. Lisa had characterized practice as focused on movement education. This characterization was evident in her goals as she focused her examination on identifying movement patterns and behavioral responses and explicitly stated that her goal for treatment included patient education and self-management.

Goals and Knowledge and Skills. Goals, however, cannot directly lead to action. Students must have the content specific reasoning abilities and skills for interaction to enact these goals. With respect to clinical reasoning, students specifically need the organization and accessibility of their content specific knowledge in order to act on their goals. Limitations in knowledge organization or accessibility may prevent students from effectively carrying out their goals. For example, in the case of Mason, his reasoning strategies indicated his immediate goals of identifying the patient's pathology; however, his failure to generate a hypothesis related to sacroiliac joint dysfunction and inappropriate interpretation of the passive extension tests prevented him from identifying the patient's specific pathology.

Bethany's uncertainty about how much pain provocation was acceptable during certain tests and measures limited her ability to fully enact her goals of identifying the pathology. Thus, the goal may initiate the reasoning process, but students must be able to appropriately organize and access their knowledge, draw on their technical skills to carry out tests, and engage the reasoning skills necessary to interpret the findings in order to act on their goals.

Students' interactional skills likely also impact their ability to carry out their immediate goals during real-world patient encounters. All of the students, however, focused their interactions with the patient on gathering information and conducting tests. This lack of variation in interactions limits the conclusions that can be drawn from this study regarding the role of interpersonal skills in the reasoning process.

The Role of Reflection

Finally, this model suggests that reflection is necessary for ongoing refinement of goals in light of the actions, interactions, and responses that occur. This role for reflection in the adaptation of decision-making during unfolding situations is identified in the literature on reflective practice and expertise in physical therapy (Schon, 1983; Wainwright et al., 2010). The findings from this research support this role for reflection, as the students who engaged in more reflection in-action tended to modify their examination plans based on the unfolding data, while those who engaged in minimal reflection in action tended to follow a more rule-driven process, characteristic of novice practitioners (Jensen et al., 1992). Reflection likely also influences students' orientations to practice. This study, however, did not directly address the role of reflection in changing students' orientations to practice.

Summary of the Revised Model

The revised model builds on my initial framework of the four capacities required for clinical reasoning. This model enhances the initial framework by illustrating how the capacities work together to enable students to engage in and develop their clinical reasoning skills. This model is compatible with existing frameworks for clinical reasoning, such as Edwards and Jones (2007). Specifically, the immediate goals a clinician is pursuing may be focused on narrative/relationship building (driven by the lived world pole) or empirico-analytical reasoning (driven by the biomedical pole). My revised model builds on both my initial framework and existing models of clinical reasoning by delineating how underlying capacities impact students' moment-to-moment reasoning and decision-making.

Limitations and Further Development

This model proposes a mechanism through which orientations drive goals and the use of knowledge and skills as students engage in moment-to-moment decision-making and action during clinical encounters. This study did not directly investigate the factors that influence students' development of clinical reasoning. Further longitudinal and intervention studies will better elucidate the factors that directly impact the development of each of the capacities for reasoning. Specifically, this model points to the importance of content specific reasoning skills for clinical reasoning, yet further research should investigate the pedagogical practices that best support students' development of content specific reasoning processes consistent with their models of practice. While the findings of this study suggest that reflection plays a role in the development of students' orientations to practice, as the current literature indicates (Anderson & Funnell, 2005; Holmstrom & Rosenqvist, 2001), further studies within physical therapist educational programs should verify this link in the model.

Key Themes in the Revised Model

Three important themes emerged from the findings of this study that are integrated in the revised model. First, the revised model indicates the role of goals as a mediating frame between students' orientations and their actions. Second, the revised model indicates the cyclical nature of reasoning, reflection, action, and learning. Finally, the revised model may explain some differences in the reasoning processes of the students from the two programs.

Goals as Mediating Frame

The revised model introduces the concept of immediate goals as the mediating frame between students' orientations and their actions. As Schon (1983) noted, real world problems require appropriate framing prior to problem solving. The concept of immediate goals indicates

the role of problem framing prior to drawing on knowledge and skills to solve those problems. Schoenfeld (2010) defined immediate goals during problem solving as the task the individual is focused on accomplishing in that moment. In the revised model of clinical reasoning, the concept of immediate goals demonstrates the mechanism through which students' orientations to practice influence the knowledge and skills they draw on during clinical reasoning. Students with mechanical views of physical therapy practice formed immediate goals of identifying and addressing the patient's immediate pathology. Students who conceptualized physical therapy practice with a focus on teaching formed immediate goals focused on identifying the patient's behavioral patterns and likely responses to interventions. These immediate goals shaped the students' reasoning processes.

Learning Trajectories and Reflection

The students' actions during the patient encounter and interview responses indicate a trajectory of learning and development in both their characterizations of practice and their engagement in clinical reasoning. Learning trajectories are broad, non-linear pathways of progressively more sophisticated ways of thinking (Clements & Sarama, 2009). These learning trajectories are inextricably intertwined with the curricular tasks that promote students' learning (Empson, 2011). Students' individual characteristics, such as their orientation to learning (superficial or deep), also impact their learning trajectories within a given curriculum (Spiers et al., 2014). The varied stages of the students' perceptions of practice and engagement in clinical reasoning demonstrated in this study point to the impacts of both their orientations (as the revised model indicates) and curricular opportunities (such as clinical experiences) on their development of clinical reasoning. Critical components of these learning trajectories are students' opportunities to engage in activities, reflect on those activities, and compare their new

experiences to their existing conceptual understanding (Simon & Tzur, 2004). The cyclical nature of reasoning, reflection, and goal modification in the revised model of clinical reasoning highlights this crucial aspect of learning for professional practice.

In addition to the development of skills and knowledge, part of development as a professional in any field involves acquiring the appropriate technical language for that practice. Common technical language facilitates communication within the profession (American Council of Academic Physical Therapy, 2014). Language alone, however, is insufficient. Educators may provide technical language to students during coursework, yet that exposure does not guarantee students will use it appropriately. As the students' use of patient-centered language in this study suggests, students and novice practitioners may be exposed to the language of a specific practice and adopt that language prior to the development of skills consistent with the language. On the other hand, students may develop complex aspects of their reasoning processes without having a language to describe it. During their clinical decision-making, the students demonstrated skills in making appropriate physical therapy treatment plans, yet did not explicitly identify a physical therapy diagnosis during their assessment process. These findings point to the spiral process of learning, language appropriation, and integration. One key aspect of the revised model for clinical reasoning is the cyclical nature of learning, practice, and reflection. As the model indicates, reflection plays a crucial role not only in students' immediate decision making during the patient encounter, but also in their development of their perspectives and skills for practice. Early and consistent experience with reflective practice should support students in continual progress through the learning cycle.

Differences in Programs

Differences in program structure may have influenced the variations in the students' actions and reasoning. While the issue of integrated versus terminal clinical experiences is a critical debate within entry-level physical therapist education, few studies have investigated differences in the clinical reasoning or decision-making of students from programs with different clinical curricula. In a comparison of students' critical thinking skills, students from a program with an integrated clinical curriculum demonstrated higher levels of critical thinking than those from a program with a terminal clinical curriculum (Huhn et al., 2013). Although this current study allows only preliminary analyses of differences across programs, students from the program with an integrated clinical curriculum demonstrated greater use of reflection as well as greater focus on behavioral analysis and teaching. Integrated clinical experiences may allow students greater opportunities to explore concepts introduced during coursework and reflect on the effectiveness of their actions. By engaging in this cycle of learning, practice, and reflection throughout the curriculum, students may develop more sophisticated clinical reasoning skills during their entry-level education.

Implications for Educational Program Design

Based on findings from this dissertation study and my revised model for students' clinical reasoning, I propose three principles for curriculum development that entry-level physical therapist educational programs should include in program design to promote students' development of clinical reasoning capacities for patient-centered care. First, the curriculum should support students' development of both their orientations to practice and their knowledge and skills to enact that practice. Second, the development of reflective practice must be integrated throughout the curriculum. And finally, programs must strive for alignment among the

values they impart, the knowledge and skills they teach, and the clinical practice students need to engage in. The following section describes each of these principles in more detail.

Principle #1: Structures to Support Students' Development of Orientations and Skills

As the findings of chapters 5 and 6 demonstrated, students' orientations to practice influence their clinical reasoning and decision-making, but orientations alone are insufficient. Students must have the appropriate knowledge and skills to enact the practice they envision. An explicit model of clinical reasoning integrated across the curriculum can support students' development of a patient-centered perspective and the skills to enact that practice.

The consistent use of a model of clinical reasoning can further support students' development of patient-centered orientations to practice and provide them with a structure to organize their thinking. Use of a consistent model of reasoning across content areas can promote students' integration of varied content areas and may enhance knowledge transfer to clinical situations (Higgs, 1993; Neistadt, 1996). The influence of a model for clinical reasoning, though, extends beyond simply making an implicit thought-process visible. The nature of that model also influences students' perspectives and practices (Darrah, Loomis, Manns, Norton, & May, 2006). The use of a patient-centered model of clinical reasoning within entry-level education may help students better develop their understanding of true patient-centered practice and the biopsychosocial model of practice. This impact on perspectives on practice may be particularly important as current literature suggests that physical therapists overall need to develop deeper understanding of the biopsychosocial model (A. Bishop & Foster, 2005). Clinicians' partial understanding of the biopsychosocial model (as evident in many clinicians) leads them to address psychological and medical issues separately rather than working with the patient as a whole person (Singla et al., 2014). The consistent use of an integrated model of clinical

reasoning (such as Edwards & Jones; (2007) across the curriculum may support students' development of the clinical reasoning process and a patient-centered orientation to practice (Christensen & Nordstrom, 2013). The use of a consistent model of clinical reasoning and content integration across courses not only provides students with a framework for organizing their knowledge across courses and clinical experiences but also supports students in developing a patient-centered orientation to practice and the skills to enact that practice.

Principle #2: Ongoing Emphasis on Reflective Practice

The findings from this study indicate a critical role for reflective practice in students' development of effective clinical reasoning. As this study demonstrated, reflective practice plays a role not only in students' reasoning and decision-making during a patient encounter, but their use of reflection is also related to their characterizations of practice and their perceptions of factors that influenced their practice. Effective skills in reflective practice enable students to manage uncertainty during clinical experiences and develop their orientations and skills for practice. Students can only reap these benefits, however, if the development of reflective practice is supported throughout their educational program.

Managing uncertainty in the clinic. Based on the findings from chapter 5 and the proposed model of clinical reasoning, reflection plays a critical role in the management of unexpected findings during a patient encounter. During real-world clinical situations, students face poorly defined problems that require them to determine what to attend to and how to frame the problem they will address (Schon, 1983, 1987). Reflection in- and on-action can help students develop the necessary flexibility in their thinking required to frame and address the unstructured problems they face in the clinic (Schon, 1983). Exercises that support reflective practice across classroom and clinical experiences can help students build the links they need

between analytical reasoning and patient-centered care (Epstein, 1999) and transition their thinking to clinical applications (Crandall, 1993; Wainwright et al., 2010, 2011). As students transition to clinical affiliations, activities that support the students in questioning their assumptions about the patients and situations they face can further help students move beyond simple repetition of previously learned concepts to develop their reasoning capacities (Donaghy & Morss, 2000).

Development of orientations and learning from practice. Reflection on action can help students integrate their clinical, classroom, and personal experiences and gain insights into how these experiences impact them. The use of reflective writing exercises have helped medical residents develop self-awareness of how their personal experiences impacted their professional learning and practice (Brady, Corbie-Smith, & Branch, 2002b). Reflective activities that support students in questioning their current assumptions about patient-practitioner interactions can support students in shifting their orientations to practice (Anderson & Funnell, 2005; Holmstrom & Rosenqvist, 2001). Reflection on action not only enables students to examine and develop their perspectives on practice, this reflection is also critical for their ongoing learning from practice. Even within basic science courses such as physics, the quality of students' reflections on learning was associated with the level of learning gains in the course (D. B. May & Etkina, 2002). Without the capacity for reflection, students will be limited in their ability to learn from experience, as it is not the experience itself that promotes learning but the process of thinking about the experience (Hayward et al., 2013; Shulman, 2004).

Support and practice in reflection are critical. In order for students to engage in reflective practice and learn from their experiences, educational programs must provide structure and support for students' development of reflective abilities. Journal writing and small group

discussions are frequently employed as reflective activities. For example, journal writing and peer group sharing occurring on a daily basis during clinical affiliations helped nursing students develop self-awareness and self-directed learning (Riley-Doucet & Wilson, 1997). Journal writing alone does not indicate development of reflection. Students will focus on the elements that are assessed, thus using a framework for assessing reflective writing can increase student motivation and provide faculty with a way to give structured feedback and determine areas for improvement (Pee, Woodman, Fry, & Davenport, 2002; Plack, Driscoll, Blissett, McKenna, & Plack, 2005). Writing clinical narratives provides students and clinicians with an opportunity to re-process a clinical encounter and consider alternative perspectives (Greenfield, Jensen, & Mostrom, 2012). Narrative and reflective writing, however, must be taught, developed, and practiced across courses and throughout the curriculum. In order to engage in reflective practice, students must develop an understanding of its value and the skills to enact the practice (Greenfield et al., 2014).

Principle #3: Alignment of Values, Knowledge, Skills and Practice

As the findings from chapter 7 suggested, students may develop different perspectives on and skills for practice based on differences in program structure both internally (within the didactic portion) and through clinical experiences. A curriculum for professional learning needs to be one of continuous growth not disconnected pieces (Dewey, 1974). In order to foster this continuous growth, programs should strive for effective connections between classroom and clinical learning, and alignment of their implicit and explicit curricula.

Connection from classroom to clinic. Some of the differences evident in the students' approaches to the patient encounter between the two programs may stem from the differences in timing and integration of clinical experiences at the two programs. Clinical experiences help

students build contextual understandings and awareness of their role in clinic (Charlin et al., 2007). Prior studies have identified the disconnection between classroom learning and clinical experiences as a problem in PT entry-level education (Jensen & Paschal, 2000; B. Richardson, 1999a). Other researchers have suggested that cultural differences between the classroom and the clinic limit students' abilities to transfer their learning to clinical settings in which awareness of critical features of social/environmental context is critical for effective action (B. Richardson, 1999a). As I discussed in chapter 7, clinical experiences throughout the program may play a crucial role in students' development of a conceptual model of physical therapy practice and reasoning (Collins et al., 1987). These experiences could further enhance teachers' abilities to situate the task of clinical reasoning and provide varied examples in practice (Collins et al., 1991).

While outside clinical experiences provide the greatest opportunity to understand context, case studies and community patients may provide some support for students' capacities for integrating their content knowledge for clinical practice. During case study activities, when students are provided with more details of the patient's life situation, they develop more detailed and individualized treatment plans and better situate their interventions in the social context (Neistadt et al., 1998). The use of longitudinal case studies across the curriculum may prompt students to include greater consideration of psychosocial factors and integration of multiple knowledge sources in their patient care (Loghmani, Bayliss, Strunk, & Altenburger, 2011; Strunk, Altenburger, Bayliss, & Loghmani, 2012). Bringing community patients into the classroom may further enhance the benefits of case study work, providing students with greater exposure to the type of interactive skills needed for clinical care, within the controlled environment of the classroom (Piper Kelly & King, 2012).

As the findings from chapter 7 suggest, the timing and types of clinical affiliations, community patients, and case studies that students experience may impact their perspectives on practice and approaches to patient care. Coordination of classroom coursework and clinical examples and affiliations is necessary to best support students' development of patient-centered clinical reasoning.

Alignment of implicit and explicit curricula. Not only should programs strive to connect students' learning from classroom to clinic, they also should strive for alignment between their stated values and actions. The alignment (or lack thereof) between a program's implicit curricula (the values and expectations communicated to students through the program structure and faculty behaviors [Jensen, Paschal, & Shepard, 2013]) and the program's explicit goals can impact students' developing orientations to practice. A greater alignment between the implicit and explicit curricula can help foster consistent professional identity development in students (Ajjawi & Higgs, 2008a; Shepard & Jensen, 1990). Students' development of clinical reasoning skills is intertwined with their development of their understanding of the profession and their professional role (Ajjawi & Higgs, 2008b). The disjointed approach to teaching and assessment currently employed in many programs (teaching and assessment focused on multiple choice exams and getting the "right" answer) can limit students' development of reflective ability and influence their perspectives on practice (Coles, 1998). In order to foster the types of learning students need for a deep understanding of clinical reasoning, programs must align teaching and assessment with their goals at the program level because individual interventions and assignments seem ineffective at changing students' approaches to learning (Entwistle, 1991; Higgs & Boud, 1991; Mann, Gordon, & MacLeod, 2009; Sadlo & Richardson, 2003; Trigwell & Prosser, 1991). Implicit curricular factors, such as faculty attitudes and types of assessments,

may exert as strong an influence on students' orientations to practice as do explicit teachings (Ho, Yao, Lee, Hwang, & Beach, 2010). As I discussed in chapter 4, in addition to alignment of teaching and assessment, the representations of practice that faculty model further influence students' perspectives on practice and skills for practice (Grossman et al., 2009; Santasier & Plack, 2007). Course ordering, methods of assessment, and models of practice all communicate values to the students (Kieser et al., 2009). Appropriate alignment can support students' development of patient-centered clinical reasoning, while variations in alignment may explain some programmatic differences such as those noted in chapter 7.

Summary of Curricular Principles

Entry-level physical therapist education should prepare new clinicians for the demands of practice they will face in the future (Wojciechowski, 2015). While there currently are no clear models for the most effective approach to physical therapist education (Gwyer & Hack, 2015), there is a call to address education from a more unified perspective at the programmatic level (Graham, 2015). The three principles described above contribute to a curriculum that works as a whole to foster students' overall professional growth, including patient-centered perspectives on practice and the skills to enact that practice. The Commission on Accreditation in Physical Therapy Education (2014) defines teaching as "activities related to developing the knowledge, skills, attitudes, and behaviors of students necessary for entry to the profession." As such, curricular design for entry-level physical therapist education should address the three principles in order to best foster students' development of perspectives and skills consistent with patient-centered care. This dissertation study has begun the process of examining the complex inter-relationships of physical therapist students' clinical reasoning and perspectives on practice. The model and the recommendations may guide physical therapist educators in curricular design to

provide students with the optimal experiences to enhance their development of patient-centered clinical reasoning.

Limitations and Future Research

This study has examined physical therapist students' clinical reasoning and characterizations of practice at two entry-level physical therapy educational programs. This study, however, has five primary limitations that should be addressed in future research. First, this study included a small sample size of four students from each of two programs. While the findings from this study provide an in-depth examination of these students' reasoning processes within the context of these programs, research that examines a larger population and inclusion of more programs will enhance our understanding of students' clinical reasoning in the broader context. Second, the use of a clinical simulation (standardized patient) in place of clinical observations may have limited the types of interactions the participants engaged in with the patient. The clinical simulation allowed for consistency across observations; however, this setting removed many of the contextual factors from the patient-practitioner interaction. Further, the single visit scenario did not allow for examination of the participants' engagement in ongoing relationship building with the patient. Additionally, the use of a standardized patient shifts the power dynamic between the patient and participant because unlike a typical healthcare situation, the standardized patient is the person who is more certain of the situation and knows the expected diagnosis (Fins et al., 2013). Third, this study examined students' perspectives and clinical actions, yet did not examine the broader teaching practice or culture within the students program. Surface program features such as the timing of clinical affiliations likely impact students' development of clinical reasoning, yet as discussed, more widespread factors such as models of clinical reasoning demonstrated (explicitly or implicitly) by faculty, language use

within the program, and types of assessments employed also likely influence students' clinical reasoning and perspectives on practice. Future studies (possibly building on the work of National Study of Excellence in Physical Therapist Education; (Gwyer, Hack, Jensen, Mostrom, & Nordstrom, 2015) that involve classroom observations and faculty and administrator interviews could better elucidate the complex factors that influence students' development of clinical reasoning. Fourth, to truly examine how students develop their clinical reasoning abilities, future studies using methodologies similar to those employed in this dissertation study could track changes over time in students' perspectives and clinical reasoning and decision-making. Finally, this study did not attempt to link the students' current clinical reasoning or perspectives on practice to their academic or clinical performance. Prior studies have indicated minimal relationships between students' academic and clinical performance (Luedtke-Hoffmann, Dillon, Utsey, & Tomaka, 2012; Sisola, 2000). As discussed, clinical reasoning and reflective abilities may play a role in students' capacities to transition from classroom to clinic. Further examination of the relationship between students' perspectives on practice, clinical reasoning skills, and academic and clinical performance may shed more light on the complex relationships.

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Appendix A Data Collection Session 1

Conceptual Perspectives Interview Questions

1. Tell me about your experiences in physical therapy so far.
    a. Please write each of your experiences with physical therapy on the cards provided.
    b. Then sort the cards into piles representing the experiences that have been most and least influential in your development as a PT
    c. Explain why you placed each experience in the pile that you did

2. What do you think physical therapy is about?

3. Describe a concrete example of a patient (that you have observed, read about or been involved with) who represents what you feel is typical of physical therapy practice.

4. Describe the ideal/expected outcome in a physical therapy patient encounter.

5. Describe a concrete example of a patient (that you have observed, read about or been involved with) who represents what you feel would be very challenging in physical therapy practice.

6. Create a metaphor for the work of a physical therapist. (further prompting: How would you describe what PT's do?)

7. During your work with a patient in the clinic, what is the role of the patient? (What do you expect from the patient? What is the patient's responsibility?)

8. Modified Q-Sort:
    a. Read through the cards provided and select the three you believe are MOST important in you work with a patient. Explain why you selected these cards as MOST important
    b. Then select the three that you think are LEAST important in your work with a patient. Explain why you selected these cards as LEAST important.

Q-Sort Topics List

1. Testing for specific tissue involvement (special tests, identifying the pathology)
2. Impairment level testing (ROM, MMT, muscle length testing)
3. Activity level testing (testing sit to stand, gait, functional activities)
4. Assessing the patient's current functional status (ability to participate in home, work and leisure activities)
5. Observing the patient's posture (static positioning of whole body or body segments)
6. Assessing the patient's pain levels
7. Learning about the patient's employment and leisure activities (what the patient does for work, pleasure)
8. Learning about the patient's level of social support
9. Understanding the patient's psychological/emotional state
10. Learning about the patient's expectations for physical therapy

Appendix B: Standardized Patient Encounter Instructions to Participant

1. The Patient Encounter
    a. You will receive the referral information for your new patient. You may have up to 5 minutes to plan your examination. You may write yourself notes as you want.
    b. You will conduct your physical therapy interview and examination as if you were conducting your initial evaluation of the patient in the clinic. Throughout the process, you may write any notes that you need to, as you would in the clinic.
    c. When you have completed the examination and assessment, you should move into the first treatment intervention, just as you would in the clinic.
    d. After you begin the treatment, the researcher will instruct you to proceed to the conclusion of the session.
    e. Use the final 5 minutes to wrap up the session as you would in the clinic.
    f. If you have not initiated treatment 35 minutes into the session, the researcher will instruct you to conclude your examination and proceed to treatment.
    g. Throughout the process you should speak to the patient as you would in the clinic. Do not address the camera or researcher.
2. The Post-Encounter Form
    a. After you have completed the session with the patient, you will fill in a written form in which you will explain your assessment and treatment plan.
3. Interview
    a. After you have completed the post-encounter form, the researcher will interview you about your work with the patient.
    b. Part of the interview will focus on explaining your thought process during the patient encounter.
4. Diagnostic Thinking Inventory (DTI)
    a. The final activity you will complete is the DTI. This is a survey regarding how you think about patient examination and diagnosis.

Appendix B: Standardized Patient Case Description: Low back pain

Patient's Name: Andrea

1. Referral information (provided to participant prior to encounter)
    a. MD referral: Low Back Pain, evaluate and treat
    b. Vitals (taken by PTA): BP: 135/85, HR: 75
    c. Insurance information: approved for 10 visits.
        i. Copay for initial visit is $75
        ii. Copay for follow up visits is $60 each
2. Case Summary
    a. Andrea is a 41-year-old who has come to PT b/c of left sided low back pain that has been going on for approximately two weeks. Andrea is a sous-chef at a local upstart restaurant. She has health insurance, but has very high co-pays for PT. She is not considered full time at her job, so she does not have any sick-leave.
3. Emotional Tone
    a. Andrea sees herself as highly independent and self-sufficient. She is highly stressed, however, by the back pain that she perceives to be threatening her ability to continue her work. Further, she does not like to admit her financial challenges. She will not "volunteer" information about her financial situation, however, will indicate the co-pays are difficult for her to make (if the PT brings up the insurance information). She also will balk at scheduling 3x/week (or any other combination of multiple times per week) if the student brings up scheduling at the end of the session.
    b. She is afraid she will have to cut back her work hours b/c of the pain/injury, and she is not sure she will be able to afford monthly expenses if she does.
    c. She is also unable to participate in her primary recreational activities (art galleries, hiking) and thus has minimal stress outlets
    d. She is also anxious about how she will continue to support/help her parents when the back pain is limiting her function.
    e. She will also balk if she is told not to lift heavy items, as this is necessary in her care for her parents and her work.
    f. If she is told to modify activities, she will push for concrete examples of how she can accomplish what she needs to get done in her work and home life.
    g. She is also unable to participate in her primary recreational activities (art galleries, hiking) and thus has minimal stress outlets
4. Overall Patient Goals
    a. Get through a complete work day without pain or at least less pain. The pain has been getting worse and Andrea is very afraid she is going to have to cut her work hours (which mean loss of income)

5. Reason for PT Visit
    a. "I've had this back pain (rub left gluteal/sacral region) for the last two weeks and its not going away."
    b. If asked what she thinks caused it, Andrea is unsure. The pain started one night at work, but she can't think of anything specific that started it

6. Additional Information
    a. Andrea's health insurance offers minimal coverage for PT. She is paying a $75 copay for the first visit and will be paying $60 per visit following (this is not something that Andrea can easily afford)
7. Personal Information/Interview
    a. Age: 41
    b. Living situation:
        i. Lives alone in second floor apartment
        ii. Cares for aging parents in spare time (parents live in 2-storey house a 10 minute drive from Andrea's apartment)
            1. Mother uses walker around the house and WC (transit chair) for community outings
            2. Helping parents includes loading WC in and out of car
            3. Some house cleaning and grocery shopping for parents
    c. Occupation
        i. Sous-chef at a local upstart restaurant
        ii. Stressful b/c of pressures to get restaurant going
            1. No one to cover → hard to take any time off
        iii. On her feet almost the entire shift (works dinner shift → 3pm to 11pm)
            1. Work demands include lifting pots and other kitchen items
            2. Sometimes reaching into low cupboards
            3. Andrea must also manage the other kitchen staff, and frequently has to cover an additional role if a staff member does not show up for a shift
        iv. Andrea finds herself frequently having to lean on the counter to relieve the pain in her back. She feels the pain is starting to impair her productivity at work.
        v. Andrea is currently on a part time (30 hours per week) schedule, so she does not have paid time off or sick leave.
    d. Hobbies, Activities, Exercise and Interests
        i. No gym membership currently, prefers to exercise outdoors
        ii. Occasional walking for exercise (has stopped since back pain progressed)
            1. Walking and hiking were part of her diabetes management
        iii. Enjoyed hiking with friends, but has not hiked since pain progressed (hiking and walking aggravate the pain)
        iv. Enjoys art films and also attending art gallery receptions (now limited by pain)
    e. Onset of current condition
        i. Not entirely sure, thinks it was about 2 weeks prior
        ii. Had been working an extra long shift at work and felt pain after slipping on a wet spot on the floor → thought it would go away with rest like prior back pain had (but this was lower/different location than prior pain)
        iii. Still had the pain the following morning (prior back pain had always fully resolved after a good nights sleep)
            1. Hoped the pain would eventually "wear off" but it hasn't
            2. Pain continues, better and worse days (depending on how much standing and walking)

f. Pain Patterns
    i. Pain is left sided low low back (inferior to PSIS, lateral to sacrum)
        1. When walking or longer than 10 minutes, also has tightness in lateral thigh wrapping to lateral/anterior knee
        2. Sometimes also gets a tightness in lateral leg
    ii. Pain description
        1. Back pain is aching (ongoing), sometimes sharp/burning (especially with forward bending), intense aching/pinching with walking
        2. Lateral leg pain just feels tight and sometimes achy (not tingling or shooting)
            a. Pain/achy/tightness runs down lateral thigh and wraps around knee
        3. Pain does not wake her up at night, but sleeping on right side leads to more pain in the morning
    iii. Pain Rating
        1. 1-2/10 at rest (at least 30 minutes after walking or standing)
        2. 8/10 with forward bending (in motion, then maintains at a 4/10 for 10-15 min)
        3. Standing > 10 min → ↑ pain
            a. 30 minutes of continuous standing → 6/10
            b. Pain slowly creeps up the longer standing
            c. The longer she's been standing, the longer (sitting or lying) it takes for pain to subside
            d. Pain is usually up to a 6-7/10 by the end of her work shifts in spite of her attempts to shift position
        4. Walking:
            a. 10 min walking → 5/10
            b. 30 min → 7-8/10
            c. Hasn't walked more than 10-20 min due to pain
    iv. Aggravating factors
        1. Prolonged standing (>10 minutes)
        2. Walking
        3. Stairs (stepping up with Left)
        4. Picking up items from floor (increased pain in motion of bending down and coming back up, OK if just remaining in a fully flexed position)
        5. Moving from sit to stand
    v. Easing Factors
        1. Sitting
        2. Lying down (on back or on left side with pillow b/c knees)
            a. Lying on right side leads to aching in the low back over time (even with pillow b/t knees)

g. PMH
    i. Type II Diabetes (diagnosed 2 years ago)
        1. Currently trying to control with diet and exercise, but back pain has limited exercise and blood sugar control has not been as good
        2. Checks blood sugar once daily
        3. HbA1c 6.3% (last test was one month ago)
    ii. Borderline hypertension
        1. Current BP 135/85
    iii. Prior Injuries
        1. Left knee tendonitis (in high school → competed in long jump and L leg was take off leg)
        2. Occasional back pain (higher in back than current complaint, more at thoraco-lumbar junction) following long work days (last bought was 6 months ago)
    iv. Medications
        1. Advil for back pain (3x200 mg two times per day for pain)
            a. Cuts the edge off the pain, but not complete relief
        2. Saw physician, who offered stronger pain meds, but Andrea prefers to minimize medication use (also has high co-pay for prescription meds)
        3. Physician referred to PT → no films done
    v.

8. Examination Information (details of examination information to be added specific to the standardized patient (SP))

a. Posture (based on SP)
b. Functional Activities
    i. Forward bend (pick up item from floor)
        1. Supports self on thighs (walking hands down) or by using one hand on the table
        2. If asked to do it without support, perform very hesitantly → highly pain provoking
    ii. Step up
        1. Quick weight shift on and off of left (trying to stay off it going up, not quite as bad going down, but control is not good)
    iii. Gait
        1. Mildly asymmetric, reduced weight bearing and weight shift to left
    iv. Single leg stance
        1. Greater sway, less stability standing on left
        2. Pt complains of increased pain during single leg stance on left
    v. Sit to stand
        1. Increase in pain on moving from sitting to standing
        2. Mild weight shift towards right
        3. Maintains slightly flexed posture on achieving standing
c. Special Tests
    i. March test
    ii. Forward bend test

1. Pain on bending down and returning to standing

iii. Stork test (back extension while standing on one leg)

1. Pinching pain in left posterior hip/gluteal region

iv. SIJ compression tests → irritating but not as painful as the forward bending
v. SIJ distraction is not aggravating
vi. Thigh and sacral thrust tests are aggravating

d. MMT
   i. Hip Extension: weaker L than R
   ii. Hip abduction: weaker L than R
   iii. Quads, Hamstring, ankles, toes are equal on both sides
   iv. Abdominals moderate but not fully strong
e. Muscle Length
   i. Tight piriformis on L
   ii. Tight psoas on L
   iii. Gluteal muscle length WNL, but pt reports it feels tight
   iv. Hamstring muscle tightness and soreness
f. ROM (to be based on SP)

Appendix C: Post Encounter Form
Adapted from (Durning et al., 2012)

1. Give a one sentence summary of your impressions of this patient

2. List the top three ideas you have regarding an assessment.
    a.
    b.
    c.

3. What is your most likely assessment?

4. Provide four key findings from your interview and examination with the patient that support your assessment
    a.
    b.
    c.
    d.

5. Problem list: List the top four problems for this patient
    a.
    b.
    c.
    d.

6. What is the most important PT intervention for this patient?

7. List four key findings from your interview and examination that support your choice of intervention.
    a.
    b.
    c.
    d.

Appendix D: Interview Questions for Post Encounter Interview

1. Prior to patient encounter: What is your goal for this patient session? What do you hope to accomplish? (prompting: what would be an ideal outcome?)

2. Prior to video review: What were your first thoughts when you first started to work with the patient?

3. Session/Video Review: Prompted by researcher's notes from patient encounter and review of the video (Wainwright et al., 2010):
    a. What are you thinking here?
    b. Why did you ask __ (or why did you do ____) here?
    c. What did you make of the response/finding?
    d. How did this information help you?

4. How did you arrive at your assessment (Jensen et al., 1992)?

5. Describe your approach to treatment for this patient (Jensen et al., 1992)?

    a. What is the highest priority?

    b. Explain what all you would have done during this first session with the patient.

    c. Explain what you would do on ensuing sessions.

    d. What do you think will be most challenging?

6. How would you know if you have been effective in your treatment (Jensen et al., 1992)?

7. What experiences most influenced your work with this patient(Wainwright et al., 2010)?
    a. Probing: what experience in PT school? What experiences with PT prior to PT school? What clinical experiences in PT school? What other life experiences? What types of mentoring?

8. If you could do this encounter over again (Sandholtz, 2011):
    a. What would you do the same?

    b. What would you do differently?

9. Basic Demographic Questions
    a. What practice areas of physical therapy are you most interested in?
    b. What clinical experiences (if any) do you have in physical therapy?
        i. Volunteer experiences?
        ii. Aide experiences?
        iii. Short term clinical experiences? (integrated? If so, what format)
        iv. Long term clinical experiences?
    c. What work experience do you have besides physical therapy (if any)?
    d. What is your age?

Appendix E: Standardized Patient Training Process

Standardized Patient (SP) Recruiting and Training Process as described in (Wallace, 2007)

1. Recruiting the SP (6-8 weeks prior to data collection)
    a. Acting ability: need to accurately portray the patient role
    b. Observation skills: need to be able to observe the participant's behaviors while acting the role
    c. Interest in the nature of the patient/case portrayed
    d. Reliability: ability to repeat the same performance
    e. Audition Processes:
        i. Auditions are video recorded
        ii. Have a case summary (not the complete case material) available for SP at audition (primary complaint, some PMH, affect and emotional state during visit, some personal background)
        iii. Actor's own physical characteristics (and possible prior scars) → must not confound the case
        iv. Assess candidates tendencies to share too much information
2. Training Process (overview)
    a. Expectations clarified: portray the role, complete overall assessment
    b. Clarification of Standardization
        i. Consistency of facts
        ii. Consistency of behaviors
        iii. Consistency of psychological/emotional state
    c. Have a clinician not familiar with the case validate the authenticity of the performance
3. Training Session 1
    a. Familiarization with the case
    b. Progressive interview with coach acting as PT student
4. Training Session 2
    a. Repeat interview/encounter with coach acting as PT student
        i. Authenticity of performance
        ii. Standardization/consistency of performance
5. Training Sessions 3 to 5
    a. Third-year physical therapist student verification of performance (students unfamiliar with the case)
6. Final Verification
    a. Recent graduate (physical therapist license applicant (PTLA)) verification of performance

Appendix F: Conceptual Interview Coding Tables

Table 1

	Category	Example Quotation
Purpose of Encounter (Dall'alba, 1998)	Fixing a Problem	Being a physical therapist is like… it's like being a car mechanic. Someone brings in their car, it's broken, and a physical therapist is expected to put it back together and fix it, so it's running like new, if not new, as good as you can get back, just repair it. (Peter)
	Assessing and Educating the Patient	I saw like this and all of these people come in and they have this very stooped posture and forward head and all that kind of good stuff and so a big thing even though it wasn't specific, they didn't come in for postural re-ed but from what we know about posture for the neck and for the shoulder and how the shoulder works, the big thing that I was treating was postural re-ed so I was giving them very specific postural exercises to affect their neck positioning. (Lisa)
	Support the patient while diagnosing and treating	I think a big part of it, you're kind of, you have to befriend the person too and you have to gain their trust and then, once you gain your trust, they're confident you know what you're doing and then I feel like you're more effective in treating. (Kelly)
	Finding a way together	He let him tell his story, he asked him a couple questions, but it was a lot more, the patient's objective was more led by the patient, rather than Victor asking five questions and interrupting him, so I think that really, hopefully is more of the example of what the therapist is that we really let them tell their story because that's going to guide where we go from there. (Sophia)
	Teamwork	I guess something that would be typical in my mind would be first meeting with the patient and you know just seeing what they want accomplish, seeing what their goals are, and then really having a combined effort to whether it's with just the patient or with their family, to figure out what the best intervention would be yeah I think that would be the best thing and then go from there. (Chloe)

Table 2

	Category	Example Quotation
End Goal of Practice (Gilliland & Fischer, 2014)	Physical Function	I guess whatever their function level was prior to their injury or prior to their condition maybe, so like if it was a stroke patient, get to the point where you've improved as much as you can improve. Improve whatever the impairment is, so whether it be function or balance or range of motion, anything like that. (Chloe)
	Return to Life Activities	I love the challenge, but. It's very difficult b/c you are dealing with some many other factors like depression or cognitive effects. And plus they, you know, they have a full life before whatever accident they might have had, so children and you know, husband and they were independent in the bathroom and now they are, it's very very difficult, so. Yeah that was a really challenging situation. (Mason) I mean, cause there are so many settings. If the kid can sit up through class without pain. If somebody can walk without tripping themselves or if somebody can wash their hair without shoulder pain, just whatever it is they need to do in their everyday that they couldn't do before. (Hannah)
	Quality of Life	So I guess it's more, just awareness and just having fun out of it. That's what I think peds PT is about. Its not just OK, you're getting better, you're having better ROM, but for kids, it's like they don't care about those things. They just want to have fun and just be able to participate in play. Or whatever their age appropriate stuff is. (Bethany)

Table 3

	Category	Example Quotation
Nature of Knowledge in the Encounter (Dall'alba, 1998)	Medical (PT) knowledge	Well I expect them to at least try everything I mean I want them to be able to be responsive to what I'm telling them, you know be, try their, I mean if I correct them I want them to really try to do the correct thing, I mean unless they're really in pain I want them to listen to what I'm saying and try to like do, for example, exercises correctly or I want them to be able to. (Kelly)
	Both parties knowledgeable	You go to the doctor they give you prescription, they give you something that's going to fix you, PT you are just as much the fix as I am, and so I need input from my patients, sometimes that frustrates them. I ask them like okay do you feel like you're up to blah blah blah, and they'll say well you tell me, you're the therapist, and I'm like I don't know I'm not inside your body, I don't know how you're feeling, (Sophia) We can determine a treatment but we can't prioritize our treatment and our ideas to cater to them, so I feel like the patient's role is to really try to communicate what it is that's bothering them and they're the reason we're there so I feel like they're the bulk of it. (Hannah)
	Interaction as important as Diagnosis	So PT as a profession connects patient to patient. So you have group exercises, so you can connect patient to patient. And you can connect patients with their family through like education. And also how to incorporate the disability into their lives or the patient's life. And then I guess a bridge to other health care professional. (Bethany)

Table 4

	Category	Example Quotation
Patient's Role (ideal) (Gilliland & Fischer, 2014)	Passive	So there's a clunk in the car. First thing as a mechanic what I would tell the patient is, what I need to do first is I need to assess. I need to see what could be causing the clunk and then kind of start with. OK it could be these 5 things. Now let me know go through my list and run these diagnostic tests. Is it the pistons, is it the exhaust, is it, whatever it is, you know. The metaphor doesn't have to be exact, but as long as the point gets across that. You know, like a mechanic, you are going to systematically have to break down what could be causing the issue and then what am I going to do to fix it. If what I did doesn't fix it. I need to go back to my hypothesis list and try again. Something like that. (Mason)
	Compliance	Well I expect them to at least try everything I mean I want them to be able to be responsive to what I'm telling them, you know be, try their, I mean if I correct them I want them to really try to do the correct thing, I mean unless they're really in pain I want them to listen to what I'm saying and try to like do, for example, exercises correctly. (Kelly) There is a lot of time spent at home that they need to work on, whether it is postural re-education, decreasing aggravating factors or changing the work environment, whatever it may be. That homework needs to be put in on their end. (Mason) I also would like to see the patient's compliance. Make sure that the patient is keeping up on their end of the bargain, b/c if you think about it; they maybe have an hour and a half to two hours per week in that clinic. Maybe three, whatever it might be. There is a lot of hours outside that clinic. (Mason)
	Learn then Do	I would expect them to maybe take my teaching and implement it at home and I guess keep an open mind to maybe the interventions I may be suggesting. (Chloe) So that way they can avoid recurrence of injury. I want to make sure that that person doesn't have to come back in time and time again for the same issue. So patient education is huge on making sure that they don't use up their insurance dollars on PT. (Mason) All of these people come in and they have this very stooped posture and forward head and all that kind of good stuff and so a big thing even though it wasn't specific, they didn't come in for postural re-ed but from what we know about posture for the neck and for the shoulder and how the shoulder works, the big thing that I was treating was postural re-ed so I was giving them very specific postural exercises to affect their neck positioning, their head positioning, and their shoulder positioning to work on their neck and shoulder pain. (Lisa) And I think it's just hard to balance out between telling them, "Okay well this is what's causing your problem so we're going to address that with exercise or with whatever but if you want we can do some of that later. So it's kind of like dealing with a child, almost. Kind of negotiating, because you want the compliance but you don't want to bombard them with everything clinical because they might not understand. (Hannah)

	Category	Example Quotation
	Learn/Understand	Learning how to move better, learning so that the patient knows how to manage their symptoms, the patient knows their limits and what they shouldn't be doing, that they're actively trying to break their bad habits and when they, I always say that they're graduating from PT and so these are your exercises and I try to teach them where to go from there, so that they kind of understand why they're doing their exercises, what the benefit of it is to them. (Sophia)

Appendix G: Coding Tables for analysis of clinical reasoning and decision-making

Table 1A: Physical therapy examination: Interview (American Physical Therapy Association, 2003)

Code	Description
Employment/ Work/ Activities	Work, community and leisure activities, tasks (including home/ADL demands) (This code applies to gathering this information, not assessing the current functional state in these activities)
	Subcodes specific for Occupation and Recreational Activities
Clinical, Lab or Imaging Tests	Inquiring about prior tests conducted (imaging studies, lab tests)
PMH and Medications	Past and current medical history (includes systems review) and current/past medications
	Subcode specific for Diabetes: Specifically inquiring about the patient's diabetes and/or management
General Health Status	Overall physical and emotional status (includes gathering data such as stress level, depression etc)
Current Condition/ Chief Complaint	MOI, description of complaint, onset, prior onset of this complaint, prior treatment for this complaint
Living Environment	Home and work physical environment/characteristics
Patient preferences/ values	Important patient activities, hobbies, occupation
	Subcodes: Patient Goal, Patient's privacy concerns, Patient's preferences for position
Social History	Cultural beliefs, family/caregiver resources, social activities, interactions and support
Social Health Habits	Smoking, dirking, exercise, drugs, level of fitness
Functional Status/ Activity Level	Current and prior functional abilities: gathering information on the pt's abilities to function in employment, work, leisure and family activities

Table 1B: Physical therapy examination: Examination codes (American Physical Therapy Association, 2003)

Code	Description and Subcodes
Joint Integrity and Mobility	Special tests
	Subcodes: SIJ Specific tests, Lumbar P-A tests, Lumbar passive motion testing
Gait, Locomotion and Balance	Assessment of gait and balance testing
	Subcodes: Gait, Balance Testing
Palpation	Assessing tissue consistency by feeling with fingers or hands.
Functional Activity Testing	Includes work/play activities and self-care/ADL activities (ICF activity level testing) (overlaps with ergonomics and body mechanics, self-care and home management, and work, community and leisure integration)
	Subcodes: Pick up item, Supine to sit
Pain Data	Pain ratings, pain location, pain description, aggravating or relieving factors, also associated factors (catching, grinding etc.)
	Subcodes: Pain Location, Pain Description, Pain Rating, Agg/Easing Factors, Pain Patterns, Other Pains
Posture/Static Observation	Observation of whole body or specific structural alignment
	Subcodes: Whole Body Posture, Pelvic Alignment, Leg Length Assessment
Range of Motion testing	AROM, PROM and muscle length testing
	Subcodes: Spinal flexion/extension AROM, Spinal Sidebend/Rotation AROM, Hip Flexion PROM, Hip Extension PROM, Hamstring Length, Knee Flexion PROM, Hip IR/ER PROM, Prone Press Up, ITB Length Test
Muscle Performance	MMT, muscle endurance and power
	Subcodes: Abdominal MMT Multi-Direction Core Stability Test, Hip Abduction MMT, Hip Adduction MMT, Hip Extension MMT, Hip Flexion MMT, Hip IR/ER MMT, Knee flexion/extension MMT, Prone Active Lumbar Extension, Ankle MMT
Nerve Testing	Assessment of neurological function
	Subcodes: Reflex Integrity, Sensory Integrity, Straight Leg Raise, Slump Test, Prone Knee Bend

Table 2: Patient interactions (Jensen et al., 1990)

Code	Description	Example
Simple Commands	Treatment or examination procedures	"so hold that position there. I'm going to try to push your leg down, don't let me move it down. Hold. Hold it. Okay, one more time. Up here, hold that. Don't let me move it. Hold. Hold" (Hannah)
Social Exchange	Exchange unrelated or peripherally related to treatment, humor	"Hi, I'm Peter, Nice to meet you." (Peter)
Rewards/ Encourages	Praising and reassuring, not educating, patient	"Good. Alright those are strong, that's good." (Chloe)
Instructions on Activity	How to do an activity	"Okay, good. So I want you to start doing that at least twice a day for 20 minutes a day so we'll, we'll end our treatment today with uh ice after we do uh, a couple of exercises." (Sophia)
Explanation	Statement that informs or explains why to a patient	"Okay so I can tell that you're having a lot of low back pain from your, your telling me everything about what started the pain as well as the location and I think, at least part of the issue is also SIJ too so that's really low cause you have a lot of those positive tests. So I think the best, thing for us to do is to start doing some strengthening exercises to start kind of strengthening this area up." (Kelly)
Seeks information	Requesting information (interview, data collection, feedback) from patient	"In the last 2 weeks, has it gotten better, worse or stay about the same?" (Lisa)
Clarification/ Confirmation*	PT clarifies what patient said or repeats it to confirm	"A 1? Okay. And is that with medication or with no medication?" (Bethany)
Visit Planning	Determining next visit/ scheduling	"So we can show you a few stretches and if you, treatments that you can do yourself. That way maybe you can come in here once a week. So you're not, you know, paying too much money each time and that can kind of, cause that can kind of add up." (Mason)

- Not part of original coding scheme

Table 3: Hypotheses (Jones et al., 2008)

Code	Description and Subcodes
Impairment (body function)	Physiological or biomechanical function (i.e.: ROM, Strength, Sensation, Pain)
	Subcode: Pain Irritability Level (Assessing how irritable the pain level is, Factors that affect the pain)
Pathology/ Medical Diagnosis	Tissue healing processes, pain mechanisms (inflammation etc.), using medical terminology (i.e.: tendonitis, muscle strain, arthritis, joint sprain etc.)
	Subcode: Phase of Healing (acute, chronic)
Participation ability/restriction	Abilities or limitations in involvement with life situations/activities
Examination Planning*	Generating an idea for further examination
Precautions Contraindications to PT	Activities, tests or interventions to avoid or proceed with caution
Contributing Factors	Identifying factors that contribute to the development and continuation of the problem
Prognosis	Making a prediction about expected functional outcomes or expected response to treatment
Unsure*	Participant indicates he/she is unsure about what is going on for the patient, or may make a hypothesis but indicates uncertainty about that idea
Patient Perspective/ Impact of Pathology	Hypothesizing about how the pathology is affecting the patient's life experience, Commenting on impacts on patient activities (i.e.: comment on pain interfering with occupation, or impairments limiting ability to play with kids etc.), also any comment about how the patient might feel/think about the situation
Structure	Body structure or tissue source, anatomical structure
PT Success*	PT states findings confirm what he/she was thinking, or PT is please with self that he/she is making progress in the dx
Patient Characteristics*	Assessment of the patient's interactive style/ personality, assessing patient's likelihood of compliance/follow through
	Subcode: Movement Characteristics (patient movement behaviors or patterns)
Management and Treatment	Developing ideas for management
Activity ability/ restriction	Abilities or difficulties in executing activities (ICF)
Ruling Out*	Determining the structure, pathology or activity is not the problem
Measure of Progress*	Data is used to assess progress or change

* Not part of Jones' et al. original list

Table 4: Physical therapy interventions (American Physical Therapy Association, 2003)

Interventions
Balance, Proprioception, Neuromuscular Training
Strengthening Exercise
Stretching and ROM Activities
Modalities
Education
HEP
Activity Modification
Not Sure* (unsure of what to do)
Further Assessment*
Functional Activities
Referral / Further testing
Environment (work set up) modifications
Soft Tissue Mobilization
Warm up/ Cardio

* Not part of original list

Table 5: Reasoning strategies (Edwards, Jones, Carr, et al., 2004)

Code	Description and Subcodes
Ethical Reasoning	Considering dilemmas that impinge on treatment and assessing the best action
Interactive Reasoning	Establishing and maintaining the patient-practitioner relationship
Reasoning about Teaching	Determining content and approach to patient education and assessing outcomes of education, rationale for teaching/explaining to patient
Reasoning about Patient Personal Needs*	Considering what the specific patient may want/ need
Reasoning about Procedures	Determining and carrying out the appropriate interventions
Reasoning about Goal Setting*	Developing ideas for treatment goals
Organizing/ Planning Examination*	Organizing thoughts for the next set of tests to conduct
Managing Uncertainty*	Trying to make sense of unclear findings
Predictive Reasoning	Envisioning and evaluating future scenarios and the role of patient and PT choices
Collaborative Reasoning	Building a consensual approach towards goal setting and treatment planning
Protocol*	Attempting to follow instructions from class or evaluation sheets from clinic
Narrative Reasoning	Seeking to understand the patient's understanding of his/her condition
Diagnostic Reasoning	Determining the active pathology, impairments, functional limitations, and contributing factors
	Subcodes: Diagnosis of Causal Factors, Diagnosis of Precautions/ Contraindications, Diagnosis of Movement Impairments, Diagnosis of Primary Pathology, Diagnosis of Functional/ Activity Impacts, Diagnosis of Severity

* Not part of Edwards original list

Appendix H: Example Quotations from Patient Encounter

Table 1: Examples of hypotheses

Code	Examples Quotations
Impairment (body function)	So that's sort of a modified Thomas test that I picked up in the clinic and it's not going to give you a number, but it's going to give you an idea if there is some tightness. And she was tight through the front of her hip. At least on that left side, and was getting a little bit of pain, and it was really easy to feel that if I got to that end, she was immediately going into some lumbar extension. So it was pretty quickly pushing her in, causing that kind of excessive lordosis. That psoas and rectus, both of them. (Lisa)
	Pain: "Just to have a, like I said from a 0% to a 100%. 0% would be a 1/10 and a 100% pain would be an 8/10 and so if she gets into a 4, that's already halfway through her tolerance. Just to see her tolerance and to see it's irritability." (Bethany)
Pathology/ Medical Diagnosis	"The mechanism of injury, the trauma, it was a fall, it was two weeks ago, there were no x-rays, I have to rule out fracture if and I think I put that on my hypothesis list if there was a fracture or a possibly a small fracture to the pelvis." (Mason)
	Phase of Healing: "It's probably – it's furthering my idea that this is an inflammatory response so that's where a lot of this pain was coming from." (Sophia)
Participation ability/restriction	"But I kind of want her to take it easy at work so she doesn't strain herself more because she does a little bit of lifting at work and then leads me to patient education to see what actually she does at work and since she cannot take time off work, she has to deal with the pain. So then I want to see if she has good body mechanics." (Bethany)
Examination Planning*	"The bending that makes sense, if its back pain, I mean I can see if she has uhm, any patterns uh and see her ranges there and just her overall mechanics of how she moves." (Hannah)
Precautions Contraindications to PT	"Just, in terms of making sure it's under control, which I didn't ask, which I should have. If it's under control that's going to affect her exercise tolerance and her blood glucose for future interventions I would want to make sure we made sure that we tested that before and after and during the exercise portion." (Chloe)
Contributing Factors	"She was really tight. She was very tight uhm, I had, for somebody that tight anytime you bend would be strenuous if you don't have that give through your hips" (Hannah)
Prognosis	"Just to see what she's willing to do just on her own. How long is it going to be until she gets better, you know she would say "yeah I'm taking it a little bit lighter" then I probably think she's going to decrease her pain sooner than she is because she's just continuing on with her regular duties." (Sophia)

Unsure*	"I was thinking okay SIJ, let me see if I can do any of those tests. I don't even know if I would take those tests because I couldn't really do them properly so." (Chloe)
Patient Perspective/ Impact of Pathology	"If it is affecting her to the point where she is taking off work, that's a big deal. But she's able to go through it, which is good. You know it's not such a bad thing that she is not able to work. She's just not able to work effectively." (Lisa)
Structure	"*And when she said she didn't have any numbness or tingling, what were you thinking?* That there was no nerve involvement." (Peter)
Patient Characteristics*	"See where she is at with that, sometimes they're not taking medications because they are in denial that there's an issue or maybe she's not taking medication because it's not as severe as you know, if she did need to take medication. It seemed like I didn't get the sense she was in denial of it. It felt more of it wasn't as severe as it needed to be." (Sophia)
	Movement characteristics: "So I wanted to see how willing she was to move for one thing. Not very willing to move. Very cautious with bending forward, which is always an interesting thing with somebody who says they are crouching things to pick up pots and pans from underneath." (Lisa)
Management and Treatment	"Just to see if she can get to a zero or just the positions that help her that ease that pain, you know resting or lying down in her case. So maybe when she comes home after a long day, that's where she'll be so she can kind of ease that pain and not keep it at an inflamed level all the time." (Chloe)
Activity ability/ restriction	"She said that going up and down stairs, I think going up particular hurts her more so I'll try to avoid that or find better ways to go up and down stairs without aggravating. Because I want her to maintain active." (Bethany)
Ruling Out*	"Well, achiness didn't really, it drove me away from thinking nerve because a nerve I would think that would be more described as a numbness or tingling or radiating" (Peter)
Measure of Progress*	"It gave me, myself, some objective goals for her, which would be to work up to having her complete a day's work without having that back pain." (Bethany)

Table 2: Reasoning strategies examples (Most commonly employed strategies)

Strategy	Example
Diagnosis of Primary Pathology	That can kind of tell if there is facet issue versus quadrant. So facet versus maybe nerve. Just to kind of rule that out. And she had a lot of pain with it but teamed with flexion and the pain with extension it's still probably not, I mean the location of pain might be facet but it's like she has mixed everything (Kelly)
Diagnosis of Movement Impairments	So I was looking at Thomas test a little bit just sort of hip flexor length. So that's sort of a modified Thomas test that I picked up in the clinic and it's not going to give you a number, but it's going to give you an idea if there is some tightness. And she was tight through the front of her hip. At least on that left side, and was getting a little bit of pain, and it was really easy to feel that if I got to that end, she was immediately going into some lumbar extension. So it was pretty quickly pushing her in, causing that kind of excessive lordosis. (Lisa)
Reasoning about Procedures	You gotta know the aggs and eases you gotta know what makes it worse, what makes it better, if you don't then I kind of feel like the therapist is just blindly sort of guiding, that's how I guide my interventions, if I know that backward bending and forward bending make it worse, I wanna try to limit that as much as possible and if side bending and rotation don't really bring it on, I'll be a little less concerned about those positions or movements, or whatever it may be. (Mason)
Diagnosis of Causal Factors	Because posture can affect low back pain, again, those mechanics, bad posture could put strain on certain areas. (Peter)
Reasoning about Patient Personal Needs	Just to know where she is heading to and make sure we're on the same page. Obviously I want her to get better, I want to not have pain. I want her to know there are a million things we want patients to do, but we can only prioritize so much. I know she wants to get back to work without pain and then go back to hiking. Just no pain, able to go hiking, and increase productivity since her back pain, her work productivity decreased, so just three goals. (Bethany)