INVESTIGATING CLINICAL REASONING
THROUGH A SERIES OF WEB-BASED CASE STUDIES

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ABSTRACT

Investigating Clinical Reasoning Through a Series of Web-based Case Studies

Clinical reasoning is used by health care practitioners to discover the nature of, and solutions to clients' problems. Students need opportunities to clearly explain and justify their decision making in order to develop their clinical reasoning skills. In academic settings it is difficult to provide students with exposure to authentic clinical cases with which they can practice and demonstrate their clinical reasoning before having to do so with actual clients. Case studies are often endorsed as the optimal way to do this. The limitations of traditional (paper) case studies are reviewed. A more authentic representation of clinical practice is presented through a series of web-based cases.

The purposes of this study were to analyze whether or not a series of web-based case studies (WB):

1) allows students to demonstrate different forms of clinical reasoning;
2) encourages students to use the web to search for resources that support learning and clinical reasoning; and
3) is perceived by students to be advantageous or preferable to paper-based cases.

The cases were designed based on constructivist learning theories and occupational therapy theories of practice and of clinical reasoning. The study uses a particularistic case study research methodology.

All third and fourth year students (36 per class) from the Occupational Therapy program in the School of Rehabilitation Sciences at the University of British Columbia in October 1999 were invited to participate in the study. Six students (all in third year) agreed to participate. One student withdrew from the study. All students were given the same three web-based case studies to complete by multiple choice and text entry responses. No time limit was imposed.

The text entry data was matched using key words to forms of clinical reasoning used in occupational therapy. Students' use of the on-line resources (e.g. tutorials, web searches, and comparisons of their responses to the experts) were tracked. Students'
preferences for WB or paper-based case studies were identified through semi-structured on-line interviews.

The students were able to demonstrate different forms of clinical reasoning using the WB. The forms of clinical reasoning most frequently evident were procedural, interactive and pragmatic reasoning and schematic processing. Conditional reasoning was used by two students and only in the final case study. The other forms of clinical reasoning were used periodically. All of the students used links built into the case studies for feedback and comparisons with expert models. Two students used the built-in tutorials to guide their decision-making. Only one student used a hot link to a site on the web. No students initiated their own search on the web. A lack of time was the primary factor reported for this. The students voiced no strong preference for either web-based or paper-based case studies. They offered positive and negative issues with both formats. For example, access to the WB and technical difficulties were at times problematic however they were also said to be thought-provoking and interesting to those same students. It is concluded that these WB are useful for students to demonstrate different forms of clinical reasoning.
CHAPTER ONE: INVESTIGATING CLINICAL REASONING ........................................ 1

The Problem ........................................................................................................ 1
Taking an Occupational Therapy Perspective on the Problem ....................... 2
Using Case Studies to Simulate Clinical Practice ............................................. 4
Investigating Clinical Reasoning through a Series of Web-Based Case Studies ... 7
Conceptual Considerations ............................................................................... 8
Research Method .............................................................................................. 9
Summary ........................................................................................................... 9
Outline of the Thesis ......................................................................................... 10

CHAPTER TWO: TEACHING CLINICAL REASONING ..................................... 11

Definitions of Clinical Reasoning .................................................................... 11
TEACHING CLINICAL REASONING IN AN ACADEMIC SETTING ................ 13
Using Case Studies to Teach Clinical Reasoning .......................................... 14
Using Web-Based Case Studies ...................................................................... 18
Summary .......................................................................................................... 19

CHAPTER THREE: METHODOLOGY ............................................................... 20

CONCEPTUAL CONSIDERATIONS ............................................................... 20
CONSTRUCTIVIST LEARNING THEORIES ............................................... 20
Sociocultural Constructivism ........................................................................... 20
Radical Constructivism .................................................................................. 21
Linking Constructivism with a Series of Web-Based Case Studies ................ 23
Structure of the Cases ..................................................................................... 25

RESEARCH METHOD .................................................................................... 25
DESCRIPTION OF THE STUDY ................................................................. 27
The Web Site ..................................................................................................... 27
The Cases ......................................................................................................... 28
Case Study Validation ..................................................................................... 29
Participants ...................................................................................................... 30
Procedures ....................................................................................................... 30
Evaluation ........................................................................................................ 31
CHAPTER FOUR: RESULTS ................................................................................................. 32

Forms of Clinical Reasoning Evident ........................................................................... 32
Sources of Knowledge Identified by the Students ......................................................... 40
Usefulness of the Cases to Promote Reflection into Clinical Reasoning .................... 40
Students’ Preferences for Web-Based vs. Traditional (Paper-Based) Case Studies ........ 41
Summary ....................................................................................................................... 44

CHAPTER FIVE: DISCUSSION AND IMPLICATIONS ................................................... 45

Engagement in Clinical Reasoning (CR) ..................................................................... 45
Searching for Resources on the Web to Support Learning ......................................... 49
Students Preferences between Web-based (WB) and Traditional (T) Case Studies ....... 51
Limitations of the Study ............................................................................................... 52
Implications for Further Research .............................................................................. 53
Implications for Teaching/Learning ........................................................................... 54

APPENDIX A ............................................................................................................... 61

EXCERPTS: TOTAL KNEE REPLACEMENT CASE STUDY ....................................... 61

APPENDIX B ............................................................................................................... 63

EXCERPTS: SOFT TISSUE INJURY CASE STUDY ................................................. 63

APPENDIX C ............................................................................................................... 67

EXCERPTS: PAEDIATRIC CASE STUDY ................................................................. 67

APPENDIX D ............................................................................................................... 73

ON-LINE SEI-M-STRUCTURED INTERVIEW QUESTIONS .................................. 73
LIST OF TABLES

Table 1. Definitions of the Forms of Clinical Reasoning Used in Occupational Therapy ........................... 13

Table 2. Case Study Descriptions .................................................. 28

Table 3. Frequency of Evidence of Each Form of Clinical Reasoning Per Case Study .................................... 32

Table 4. Forms of Clinical Reasoning Evident Per Student: Total Knee Replacement Case .......................... 33

Table 5. Forms of Clinical Reasoning Evident Per Student: Soft Tissue Injury Case ................................. 34

Table 6. Forms of Clinical Reasoning Evident Per Student: Paediatric Case ............................................. 34
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CHAPTER ONE: INVESTIGATING CLINICAL REASONING THROUGH A SERIES OF WEB-BASED CASE STUDIES

The Problem

A 19-year-old male was brought into an emergency ward of a hospital after a motor vehicle accident (MVA). On x-ray there was a fracture evident near the head of the left femur. He underwent a left Thompson's hemiarthroplasty (hip replacement surgery) yesterday. You receive a referral to occupational therapy (OT) that gives you the person's name, diagnosis, and a request to "assess and treat". How do you decide what should be the specific assessment and treatment?

The above is an example of a traditional case study (Neistadt, 1998) likely to be presented to a student in OT. Case studies are frequently used to portray examples of clinical practice. These cases can provide a minimum of information, such as the one above which is designed to have the student commence the assessment process, or provide a more in-depth view of the client and include data from tests for analysis. A case can be used towards generalization to other clinical situations or as an entity of interest in and of itself. It is important to consider what aspects of the case are representative of a condition/phenomenon and what aspects are anomalies/unique to the individual represented; can the student differentiate between them?

The student needs to consider how the assessments and interventions would change if the person who incurred the hip fracture were a 76-year-old woman who slipped in her extended care facility instead of the man described at the beginning of this chapter. The learner needs to ascertain the key features in the cases that are cues to what changes are required. For instance, the term "extended care facility" cues the student to the fact that the 76-year-old woman was likely not walking independently to get around. The context will have a direct impact on the type of hip prosthesis she gets and the type of rehabilitation that follows. In contrast, the expectation for the 19-year-old male is that he will walk functionally again. There will be restrictions to his movements that he will have to follow for three months following the surgery to facilitate a secure placement of the prosthesis in the bone and to prevent dislocation of the hip. There are standard protocols for movement and weight bearing post hip replacement surgeries. The proviso
is that there is no significant head injury causing cognitive and/or neurological damage. If this was the case then the assessment and intervention may more closely resemble that of the 76-year-old woman.

The course of action needed is client-specific. There is no one way to provide competent clinical practice, in this case treating a person with a fractured leg. Decisions are made based on the facts (as each person perceives them to be), goals, and experiences of both the practitioner and the client. The environment and resources available also influence the possible courses of action. Students in the health care professions need to become skilled at clinical reasoning in order to make appropriate decisions with a given client. Students need to learn to explore a range of assessment and treatment possibilities, select the "best" ones, and be able to explain and justify why they are the best from a variety of vantage points. The decisions derived are the end-products of clinical reasoning processes. The processes used are specific to each health-care discipline (Ennis, 1989 as cited in Raidl, Bennett Wood, Lehman, & Evers, 1995), in this case OT.

Taking an Occupational Therapy Perspective on the Problem

Occupational therapy works towards “enabling people to choose, organize, and perform those occupations they find useful or meaningful in their environment” (CAOT, 1997, p. 2). Occupation refers to what people do to occupy their time, “including looking after themselves... enjoying life... and contributing to the social and economic fabric of their community...” (ibid. p. 3). While OT students study topics in common with other health professions including anatomy, physiology, psychology, and pathology, they learn a body of knowledge, philosophy, and theoretical perspectives unique to this discipline. Their role within the health care team is a distinct one. The clinical reasoning processes focus a practitioner's thinking to identify key information, disregard extraneous data, and to analyze the situation (presenting problems, contexts, supports, and hindrances) to achieve the client's goals.

Making Knowledge Explicit

Occupational therapists use theories, models, and frames of reference to guide practice; some are shared with other disciplines and others are unique to OT and help to
define the nature and scope of the profession. While some aspects of practice can be explained simply, others can be less so. They seem to be intuitively known by an experienced practitioner but often cannot be communicated clearly to others. Putting tacit knowledge into an accessible form is not an easy task; it can be a challenge for clinicians and instructors. There is no one way to provide competent clinical practice but some ways are better than others are. Practitioners have the advantage of working with actual clients to demonstrate that which is less easily explained verbally. Getting a "hands on" feel is an important part of the learning experience for students to help them determine what course of action is best. The consequences of various forms of assessment and treatment tried can be seen, compared, and evaluated. The client can provide input and feedback as well. The task of teaching about practice, especially the clinical reasoning behind the actions, becomes even more challenging when it is removed from fieldwork to an academic setting.

OT students learn to choose from a number of theories, models, and frames of reference to guide their thinking about assessment and treatment. However, linking knowledge to application in practice is a difficult task. Returning to the initial case, the student will need to address the issue of providing the client with a wheelchair until he can walk a sufficient distance by himself. Some relevant questions include: What is a sufficient distance? How long will that take to accomplish? Will that happen in the acute care hospital or elsewhere? Is the "elsewhere" wheelchair accessible? Which type of wheelchair and accessories, if any, will he need? What support systems are available (e.g. financial, family/friends and community services)? How has he cope in the past when problems arose? Are there any other factors that will have an impact on this client's seating and mobility needs such as any conditions that might affect his vision, perceptual-motor skills, or judgement? How can the student facilitate forming a therapeutic relationship with the client to facilitate assessment and treatment? This one task of deciding on an appropriate wheelchair, let alone teaching him how to use it safely, is quite complex. The questions raised above correspond with clinical reasoning processes that will be elaborated on in Chapter Two.
Using Case Studies to Simulate Clinical Practice

In an academic setting it is difficult to provide students with realistic simulations of practice. Case studies are frequently endorsed as the optimal way to give students opportunities to investigate practice for various client populations and scenarios commonly, or uncommonly, seen in the field (Buchanan, Moore, & van Niekerk, 1998; Johnson, Cunningham, Finkelstein, & Hand, 1997; Page, Bordage, & Allen, 1995; Ryan-Wenger & Lee, 1997). They can provide a format for students to explore, explain and justify their clinical reasoning before having to do so with actual clients. Explanation is required to evaluate whether decisions made are appropriate; justification is required to ensure that the reasons behind the decisions are appropriate. Both are essential so that right actions are not taken for the wrong reasons and visa versa. The end result sought is appropriate assessment and intervention for that person (at that point in time) based on clinical reasoning that is in-depth and sound (Hagedorn, 1996; Neistadt, 1996, 1998; Robertson, 1996).

Case Studies and Clinical Reasoning

Although case studies are useful methods to portray representations of clients and scenarios seen in practice, few are very effective for instructors to assess and students to explore their clinical reasoning skills. Traditional (paper) case studies provide only a limited amount of information; they are not interactive. They do not offer further information, based on the decisions the student has made, to progress through the above elements. To provide each student in a class with results (or more information) based on these decisions at every step of the process would be an unwieldy task for an instructor. This would be costly in terms of time spent in the exercise and in lost time for additional cases. Case studies reviewed in group/class discussions, while providing the opportunity for further information to be outlined, do not allow the students to follow their own decisions; a pathway is chosen based on contributions from many students. While collaborative work is important to facilitate learning, ultimately each student needs to build the skills and confidence to be able to practice as an occupational therapist (including the clinical reasoning involved) independently.
Web-Based Case Studies and Clinical Reasoning

Hypertext and the World Wide Web (WWW) offer instructors possibilities to create interactive teaching/learning tools to focus on the development and assessment of clinical reasoning. Reasoning is facilitated using scenarios that include the following major characteristics: reflect actual clinical practice; is of interest to students; lend themselves to the application of guidelines and concern facts/issues of practice that should be learned; involve meaningful interactivity (i.e. not simply to access an animated gif or other technological feat), optimal challenge, and consequences for the learner; give feedback on the actions taken; and are of adequate duration -- lasting several sessions (Keegan, 1995).

A series of web-based case studies may offer the students the opportunity to investigate, develop, and reflect on their own clinical reasoning. The designer of the cases can include various features to plumb the students’ depth of understanding, e.g. common versus atypical clinical presentations, interdisciplinary issues, frequent errors made by students, and use of particular models of practice. From a data base, a student can begin to make decisions; additional information can be presented based on those decisions and so on simulating a more authentic representation of clinical practice. Ideally, video and audio clips of an interview or other interactions with the client will be included. Features such as on-line tutorials can be built in to facilitate and model clinical reasoning skills. Students can also use web-based case studies to access a vast array of on-line resources. Searches on the Internet, subscriptions to list servs and chat rooms, and e-mail can augment information on a given topic or provide the learner access to other students, clinicians, or clients/support groups. E-mail also offers a venue for instructor/student feedback. It remains to be seen to what extent students will take advantage of on-line resources built into web-based case studies.

Practicalities of using Web-Based Instruction

The web format, as opposed to other computer-based format such as CD-ROMs, allows a relatively low cost development and delivery of materials, and ease of updating/altering content or components as needed. A questionnaire sent to all students entering occupational therapy program at the University of British Columbia (UBC) in
1998 indicated a high degree of computer literacy. All but 2 of the 36 students had computer access from home. Access among OT students at UBC has grown from approximately 5% five years ago to the present 94%. Alternative access for students exists in campus computer laboratories. Computer literacy levels and access to computer resources suggest that use of the web-based case studies is realistic (Stanton, personal communication, November 8, 1998).

A caution is required however. The WWW is a tool that allows access to a vast array of information, and misinformation, from a range of perspectives. Courses being taught by distance education including the WWW burgeoned. Many courses are taught from a transmission approach in which students are expected to replicate information presented by the experts in the field. Inductive reasoning is rarely required. Explanations for decision making by students are not often requested. In Fletcher-Flinn and Gravatt's (1995) meta-analysis, no learning advantage was found with computer-based instruction when the variables of teacher and materials were controlled and when the studies were of longer duration. They identify the following considerations for instruction evaluation: "...cost-benefit, ...student and teacher time saving, presentation of realistic problems requiring interactive hypothetical-deductive reasoning, immediate feedback and self-evaluation, opportunities for collaborative learning in small groups, and ease of teacher monitoring and control" (p. 232). The WWW offers learner control, interactivity, and the potential for feedback although many web-based courses and course materials do not use these aspects to full advantage (El-Tigi & Maribe Branch, 1997).

Expertise in hardware, software and maintenance of the site and links needs to be considered. The more features included (such as timing and tracking a pathway through a case study) the greater the cost and complexity of the development of the course materials. Design limitations of web-based instruction need to be identified. For instance, as the WWW is an open system the designer cannot prevent the student with access to available course materials from moving forward and back through the screens at will. This movement cannot be restricted once the student has been admitted to view these materials. It is incumbent on the designer of web-based materials to ensure that content and process for using web-based materials respect student confidentiality and maximize the potential for learning.
Investigating Clinical Reasoning through a Series of Web-Based Case Studies

Students in the health professions need to be able to explain and justify their clinical reasoning in order to ensure that "appropriate" decisions are being made with their clients. Students are often given case studies to gather this information. Traditional (paper) case studies do not simulate authentic clinical practice during which practitioners gather information, make decisions, the results of which lead to further information, and so on. The presentation is static and limited. It is important that case studies simulate practice as closely as possible in order for students to have maximal exposure and practice to refine the skills that they will need as health practitioners. "Context provides important cues for storing and retrieving information" (Arseneau & Rodenburg, 1998, p. 121).

It is proposed that web-based case studies can present a more authentic representation of clinical practice than traditional paper-based case studies. The web allows for the interactivity where students participate in a more realistic sequence of information gathering and use for decision making. If actual (or simulated) video and audio clips are used then the web-based cases will further approximate clinical practice. These case studies also have the advantage of access to the World Wide Web for researching issues presented in the cases (there are over 1100 web-sites offered by Microsoft's web search engine when searching occupational therapy alone).

A series of web-based case studies (WB) was designed and developed to reflect actual practice for three "clients". The cases direct students to explain and justify the clinical decisions they make regarding client assessment. The cases offer hypertext hotlinks to progress through the cases, seek feedback, obtain guidance, and access additional information through the WWW. This study analyzed whether or not this series of web-based case studies:

1) allows students to demonstrate different forms of clinical reasoning;
2) encourages students to use the web to search for resources that support learning clinical reasoning; and
3) are perceived by students to be advantageous or preferable to paper-based cases.

References to WB throughout this thesis will refer only to the platform (WebCT, version 2.x) and design of the series of web-based case studies used in this research.
Conceptual Considerations

Three web-based case studies were used to identify the forms of clinical reasoning behind students' clinical decision-making and to identify the resources used. The cases are designed based on constructivist learning theories (Cobb & Yackel, 1996; Lave & Wenger, 1991; von Glasersfeld, 1989, 1991), occupational therapy theories of practice (CAOT, 1997; Kielhofner, 1996) and of clinical reasoning (e.g. Mattingly & Fleming, 1994; Rogers & Holm, 1991; Schell & Cervero, 1993). The results can inform teaching and learning strategies to identify and improve on areas of incomplete understanding by working within the students' "zone of proximal development" (Vygotsky, 1978).

My view of constructivism within this study is in keeping with authors and theorists who describe a link between those viewing learning as taking place in the mind of the individual and those seeing learning as a sociocultural construction (Cobb & Yackel, 1996; Rogoff, 1990; von Glasersfeld, 1989, 1991). Von Glasersfeld defines learning as "self-organization" that occurs as one interacts with others in a community. These interactions are frequent sources of dissonance between the conceptions a person holds at a given time and new ideas introduced. When there is dissonance the learner either disregards the new ideas as not plausible or changes the existing conceptions to adapt to ideas seen to be viable within a given context (1989).

...[I]n the process of participation in a shared activity, the individual already functions with shared understanding. The individual's use of this shared understanding is not the same as what was constructed jointly; it is an appropriation of that shared understanding by each individual that reflects the individual's understanding of and involvement in the activity" (Rogoff, 1990, p. 195).

It is therefore important to offer each student the opportunity to explain and justify his/her clinical reasoning. Students' shared knowledge and culture are developed during the OT program. Ways of knowing and goals particular to OT practice are both incorporated into the design of the case studies and are sought in the responses of the students. Theories of OT practice and of clinical reasoning form the structure for analyzing and evaluating the students' work upon completion of the case studies. Both the learner and the instructor can explore the depth and breadth of understanding
demonstrated through completing the cases. The aim is to further this understanding on the parts of both the student and the instructor to inform the teaching/learning of OT practice.

**Research Method**

A particularistic case study research method was used (Olson, 1982 as cited in Merriam, 1998). This type of case study examines a particular situation, event, program or phenomenon. It can suggest what (not) to do given a similar situation and illustrate a general problem. In this research, clinical reasoning is the phenomenon of interest. All third and fourth year students (36 students per year) from the Division of Occupational Therapy in the School of Rehabilitation Sciences (SRS) at the University of British Columbia in 1999 were invited to participate in the study. All of these students had completed the pre-requisite courses required to use the web-based case studies. The participating students were given three identical case studies (developed by me based on the SRS assessment curriculum) to complete with no time limit imposed. The cases required multiple choice and text entry responses.

**Evaluation**

Text entry data was evaluated using key clinical reasoning concept words to identify what forms of clinical reasoning were used (Mattingly & Fleming, 1994). The purpose is not solely to yield a descriptive account of the students' clinical reasoning but to improve it through reflection about their decision making and feedback incorporated into the case studies. Students' uses of the web options (e.g. tutorials, web searches, and comparisons of their responses to the experts), were tracked. The students stated their preference for either web-based cases or traditional (paper) case studies in on-line interviews. The triangulation of the various sources of data serves to strengthen the internal validity of the study. The students' confirmation and elaboration of their own clinical reasoning enhances the reliability of the data and the interpretation given.

**Summary**

This chapter outlined the need for an interactive and authentic avenue for students to explain and justify their clinical reasoning individually. The processes and
outcomes of their reasoning can then be evaluated to identify areas of incomplete understanding that can then be used to inform teaching. A series of web-based case studies was designed to accomplish the above based on constructivist theories of learning and occupational therapy theories of practice and of clinical reasoning. The purpose of this study was to analyze whether or not this series of web-based case studies:

1) allows students to demonstrate different forms of clinical reasoning;
2) encourages students to use the web to search for resources that support learning clinical reasoning; and
3) are perceived by students to be advantageous or preferable to paper-based cases.

Outline of the Thesis

Chapter Two discusses the teaching of clinical reasoning with particular regard to the use of case studies including web-based instruction. The constructivist learning theories that form the theoretical underpinnings of the study will be described in detail in Chapter Three. Chapter Three also elaborates on case study as a research method used for the study. The results are investigated in Chapters Four focusing on the students’ use of the different forms of clinical reasoning, sources for their clinical reasoning, and their use of on-line resources. Students' preferences for web versus paper-based cases will be analyzed. Chapter Five discusses the combined results and implications for teaching/learning and future research.
CHAPTER TWO: TEACHING CLINICAL REASONING

My interest in clinical reasoning was sparked during two years of teaching occupational therapy students in an academic setting. Students offered a range of explanations for decisions made to solve clinical problems. Sources of these explanations included personal experience, textbook answers, fieldwork training, and intuition -- it "felt right". While each of the above can be appropriate, the scope of these explanations was often limited. Similar case scenarios would be viewed as the same -- the students frequently lacked the skills and insights required to pick up significant cues that indicate a change in practice would be in order. Few assessment and treatment options appeared to be considered. The challenge for me as a teacher was to guide the students to find the significant similarities and differences between cases. I wanted them to explore a range of assessment and treatment possibilities, select the "best" ones, and be able to explain and justify why they were the best from a variety of vantage points -- using different forms of clinical reasoning processes.

This chapter examines the teaching of clinical reasoning focusing on the primary approach used: case based teaching/learning. In order to do so, the phenomenon of clinical reasoning will be outlined for the reader, the different forms of clinical reasoning defined and current trends in teaching clinical reasoning discussed. Case studies as tools for the teaching/learning of clinical reasoning will be surveyed.

Definitions of Clinical Reasoning

Clinical reasoning is used by practitioners to discover the nature of, and solutions to clients' problems. This is not a prescriptive, singular or linear process. It involves a complex interweaving of elements including knowledge in a domain of health care, awareness of potential material and human resources/limitations, and the experience, beliefs and interpersonal relationships between the practitioner and client (and others involved in that person's care). The elements and pattern of this interweaving may be tacit, especially among experienced clinicians.

Research has defined multiple forms of clinical reasoning processes making this knowledge explicit and available to practitioners and instructors. The articulation of these forms can improve teaching curricula and practices to better relate the
phenomenon of clinical reasoning to students. The concepts comprising the different forms of clinical reasoning can be analyzed individually and rewoven by the students to guide them in the acquisition of these skills.

There are marked similarities in the forms of clinical reasoning used by many health disciplines such as medicine (Elstein, 1979 as cited in Roberts, 1996); dentistry (Johnson, Cunningham, Finkelstein, & Hand, 1997); occupational therapy (Mattingly, & Fleming, 1994; Newell & Simon, 1972 as cited in Hagedorn, 1996); and dietetics (Raidl, Bennett Wood, Lehman, & Evers, 1995). Essentially each discipline discusses two components of problem solving: delineating the problem and ameliorating it. The former addresses the scope and nature of the problem, goals, and possible actions: diagnosis, assessment, and interpretation. The latter deals with planning, implementation, and evaluation. Forms of clinical reasoning are combined to incorporate these components.

Descriptions of the forms of reasoning as applied to the health sciences are found in the literature. Those applying to occupational therapy in particular are: interactive, procedural, and conditional reasoning (Fleming, 1991), diagnostic reasoning (Rogers & Holm, 1991), schematic processing (Elstein, 1979; Gagne, 1985), narrative (Schell & Cervero, 1993) and pragmatic reasoning (Mattingly & Fleming, 1994), and hermeneutics (Dilthey, 1900 as cited in Kelly, 1996). See Table 1. for definitions of these forms of clinical reasoning.

The diagnostic, narrative, interactive, and procedural types of reasoning correspond primarily (but not solely) with the assessment and interpretation aspects of problem solving as outlined above. Pragmatic and conditional types of reasoning relate largely to planning, implementation, and evaluation. Schematic processing and hermeneutic forms of reasoning are used with both problem definition and identification of solutions. Not all forms are used at all times and differences exist between those used by expert and novice practitioners (Robertson, 1996). While there is overlap in aspects of the different forms, each addresses a specific focus necessary to clinical practice. With an awareness and appreciation of how these forms of clinical reasoning relate to assessment and treatment, students may be better equipped to make “appropriate” decisions with their clients.
Table 1. Definitions of the Forms of Clinical Reasoning Used in Occupational Therapy

<table>
<thead>
<tr>
<th>Form of Clinical Reasoning</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive Reasoning</td>
<td>(Fleming, 1991) deals with creating a therapeutic relationship. Information is gathered about the person and the effects of the presenting problem on him/her.</td>
</tr>
<tr>
<td>Procedural Reasoning</td>
<td>(Fleming, 1991) involves hypothesis generation and testing about a client’s disability. Uses the evaluation and treatment methods and tools of one’s discipline.</td>
</tr>
<tr>
<td>Conditional Reasoning</td>
<td>(Fleming, 1991) the ongoing reassessment and revision of the treatment plan based on the client’s present, and anticipated future, needs and goals.</td>
</tr>
<tr>
<td>Diagnostic Reasoning</td>
<td>(Rogers &amp; Holm, 1991) uses differential diagnosis — identifying the possible causes of a problem and determining the most probable one in order to arrive at a corresponding intervention.</td>
</tr>
<tr>
<td>Schematic Processing</td>
<td>(Elstein, 1979; Gagne, 1985) conceptualizations from past learning are used to compare present scenarios to past ones. The conceptualizations are modified when new information does not fit the existing ones.</td>
</tr>
<tr>
<td>Narrative Reasoning</td>
<td>(Schell &amp; Cervero, 1993; Mattingly &amp; Fleming, 1994) involves a client sharing a personal reflection of one’s story — past, present, and imagined future patterns of behavior and thinking that effect performance in daily activities are identified used by the health professional and client to plan for desired change.</td>
</tr>
<tr>
<td>Pragmatic Reasoning</td>
<td>(Mattingly &amp; Fleming, 1994) reasoning considers the assets and limitations put on assessment and intervention based on personal, environmental, socio-economic, and institutional factors.</td>
</tr>
<tr>
<td>Hermeneutics</td>
<td>(Dilthey, 1900 as cited in Kelly, 1996) the process of interpretation moving back and forth between the whole and its parts.</td>
</tr>
</tbody>
</table>

Teaching Clinical Reasoning in an Academic Setting

Students benefit from opportunities to develop and refine their clinical reasoning skills before having to do so with actual clients. In academic settings, learners need to explain and justify their clinical reasoning to their instructors to identify conceptual stumbling blocks and areas of partial knowledge so that they can be improved upon. It is essential that students be evaluated on their ability to apply knowledge to specific contexts, not on reciting knowledge "facts." There is no one singular, correct way to
solve clinical problems or to think about solving them; however, some ways are better than others are.

Relatively little research has been done on effective ways to teach and evaluate students' acquisition of clinical reasoning skills in an academic setting. A preponderance of the research on clinical reasoning has centred on definition, theory and application to practice settings (Hagedorn, 1996; Robertson, 1996; Smith & Irby, 1997). In medicine and nursing, most of the research on clinical reasoning (in any setting) focuses on diagnostic reasoning (Barrows & Feltovich, 1987; Ryan-Wenger & Lee, 1997). The research from a variety of health professions shows consensus on using a series of case studies to teach clinical reasoning (Johnson, et al., 1997; Page, Bordage, & Allen, 1995; Raidl, et al., 1995, Robertson, 1996).

Using Case Studies to Teach Clinical Reasoning

There is a growing (yet limited) body of research on what makes a “good” case study to teach clinical reasoning. It is clear that case studies must reflect authentic practice (Arseneau & Rodenburg, 1998; Barrows & Feltovich, 1987; Ryan-Wenger & Lee, 1997; Spiro et al., 1987). Actual practice is a prospective rather than a retrospective process, therefore information is gathered over time, it is not all presented initially. New data drives decisions about further assessment and treatment planning. No limitations are put on question or examination sequence -- it should not be a dictated or necessarily linear process. In order to simulate actual practice, indications of “right” or “wrong” decisions should not be given during the process of completing the case study if the student will not be getting such feedback in fieldwork. Feedback should be delayed so that students will have time to reflect on their choices. Both common and unusual cases can be represented. The complexity that exists in clinical practice should not be simplified in case studies.

Practice in the health professions is “ill-structured” -- there is no single prototype possible; instead there are multiple representations within practice (Barrows & Feltovich, 1987; Spiro, Vispoel, Schmitz, Samarapungavan, & Boerger, 1987). Spiro et al. contend:

In ill-structured domains, crucial information tends to be uniquely contained in individual cases...aspects of different cases need to be
combined, and it is the resulting assemblages, made up of fragments of different cases, that underlie an important part of case-based reasoning. The reconstruction of knowledge requires that it first be deconstructed—flexibility in applying knowledge depends on both schemata (theories) and cases first being disassembled so that they may later be adaptively reassembled (p.186, emphasis in original).

Thus, a “good” case study to teach clinical reasoning may include the potential for scaffolding (building on the foundations of present knowledge with new content and concepts). Authentic but less complex scenarios are explored before multifactorial ones, maintaining context and domain-specific knowledge while allowing individual case presentations to differ. In these ways links can be made between cases while encouraging differences to be acknowledged. Spiro et al. (1987) insist that simplifying and “neatening” cases lead learners to use more rigid and compartmentalized approaches than is beneficial. They acknowledge however that the learners need to be sufficiently familiar with the material in order to deal with complexity and multiple types of connections between cases. To return to the example in Chapter One, not all people with hip fractures are assessed and treated in the same manner but there may well be elements that are common between them.

Spiro, et al. (1987) and Jonassen et al. (1997) recommend that case studies of authentic scenarios be designed with varying themes and perspectives represented. Links should be built to alternate perspectives and conceptions of an issue, not to additional data or references. As students proceed through the cases they reflect on their own beliefs, perspectives, and understandings. They can be asked to pose sub-questions to guide decision-making and ultimately design a solution for the case. The authors suggest themes such as autonomy and independence, logistical support tools (for analysis and synthesis of information), social and psychological dimensions, context dependency, and strategic initiatives should be threaded through all the cases. The goal is for students to be able to apply the principles learned to new and unrelated cases (Jonassen et al., 1997; Spiro et al., 1987).
Limitations of Case Studies Used in Academic Settings

Traditional paper case studies are the most common type used in academic settings. Usually, extraneous data are removed, complete information is provided at the outset, and the nature of the problem does not change as the case progresses (Barrows & Feltovich, 1987; Ryan-Wenger & Lee, 1997). Commonly, the thought processes behind the students' decisions are not requested. (Buchanan, Moore, & van Niekerk, 1998; Ryan-Wenger & Lee, 1997). Generally these cases do not unfold in response to requests for specific information; the data are simply presented which precludes the need for reasoning at each step (Barrows & Feltovich, 1987). The student is not required to explain and justify the assessment methods used, and to determine the types and amount of information needed. Negotiation with clients is not reflected. The most pertinent details that lead the students to guide treatment are not requested (Buchanan, et al., 1998).

Neistadt's research (1987 as cited in 1996, 1998; Neistadt, Wight, & Mulligan, 1998) involves the use of writing to develop students' clinical reasoning skills. She has developed a clinical reasoning case study format to utilize the forms of clinical reasoning as a thinking framework (1998). She focuses on teaching students explicitly to define and use of the different kinds of clinical reasoning outlined earlier in this chapter in order for them to achieve more complete and client-centred treatment plans.

While explicit use of the various forms of clinical reasoning may achieve the result of "better" treatment plans developed by the students, it is my view that the exercise is superfluous. Most occupational therapy schools teach models of practice specific to this discipline to guide practice and the thinking behind it. It is my opinion that the elements of each form of clinical reasoning are threaded through these models and students using these models will learn these forms. While the students will not be able to label the forms of clinical reasoning used, they will be able to explain the nature of them. The labelling of these forms is an academic exercise. Since most of the people to whom clinicians need to explain and justify their clinical reasoning are not familiar with these labels, only the meaning behind them is required. It is most important that the students are able to explain and justify their clinical reasoning based on the model of
practice used, and not necessarily on the forms of clinical reasoning, since theories are more far-reaching in guiding present and future practice.

Furthermore, the format of the clinical reasoning case studies used by Neistadt (1998) does not simulate the style and sequence of authentic practice. When case studies replicate how information unfolds in practice with information (potentially) available from standard sources (e.g. the health record and family members) no specialized case studies based on forms of clinical reasoning are required.

Comparing Different Types of Case Studies

Various types of case studies have their place in teaching clinical reasoning skills in an academic setting. Each has drawbacks inherent in their structure. Vanleit (1995) identifies a number of types of cases used in a problem-based learning curriculum. These are paper case studies, videotape, simulated clinical cases, and real client cases. She identifies the form(s) of clinical reasoning associated with each type of case presentation. The design and format of these different types vary considerably from one class setting to the next and Vanleit describes each type clearly. For instance, her version of the paper case study involves group analysis, staged introduction of new content/data over time, and research into areas of interest by each individual.

The limitations of traditional paper case studies have been discussed earlier in this chapter. The method described by Vanleit (1995) for her paper cases, while eliminating these problems, is a time consuming endeavour for both the instructor and the students. It fits in well with a problem-based curriculum but may not lend itself well to other forms of curriculum design. Videotapes of clients offer authentic snapshots of practice; the obvious drawback being that no interaction with the client is possible. A wide range of videotapes would be required to avoid the pitfall of compartmentalization (Spiro, et al., 1987). Simulation of clients involves an actor, scripts, and a staged performance. It allows for the interaction missing with videotapes but requires a very knowledgeable actor to authentically represent the client. Use of this type of case study is well suited to a group activity but not for an individual one. It is a “one off” case presentation; students cannot return to the “client” once class is over. With authentic practice students generally have repeated access to clients. Real clients brought into the
classroom bring most of the benefits and limitations of simulated case studies. Clearly the main benefit is hearing the actual story as the client experienced it.

Vanleit (1995) suggests that each type of case encourages different forms of clinical reasoning. She asserts that procedural reasoning is advanced by paper case studies although narrative and pragmatic reasoning may also be involved. Video cases develop narrative and conditional reasoning. Simulated client cases promotes interactive and narrative reasoning while real clients serve to facilitate all forms of clinical reasoning.

Using Web-Based Case Studies

Web-based instruction (WBI) is burgeoning as a tool for learning. Unfortunately many of the design problems and limitations that exist in traditional paper case studies have been transferred to their new web-based format. Further, the advantages of being on the World Wide Web (WWW or the Web) are often not capitalized on (El-Tigi & Maribe Branch, 1997). Conversely, Reiber (1994 as cited in Bannan & Milheim, 1997) cautions against “a tendency to focus on design strategies based only on the technological capabilities of the medium, rather than the goals of the lesson, the needs of the learner, and the nature of the task” (p. 382). Still, there is a rich body of literature describing instructional design, conceptual approaches and learning theories that supports WBI and there is a growing number of cases that exemplify them.

Using Web-based Case Studies to Improve Teaching/Learning in Academic Settings

Many of the limitations outlined above may be improved upon by incorporating the attributes of a "good" case study (with regard to instructional design) described above along with multimedia features, hypertext, and internet links to create a series of web-based cases. Web-based case studies may be the optimal way to simulate practice in health care without direct client contact. Digitized video and audio clips, for example, of real or simulated clients can be included within a case study and easily re-edited as need dictates. They can be reviewed as the student desires. They offer learners the opportunity to try out different ideas for thinking about assessment and treatment in a non-threatening environment.
Spiro, et al. (1987) address the application of knowledge in "ill-structured domains" such as health care delivery where because of "...breadth, complexity, and irregularity of a content domain, formulating knowledge in that domain to explicitly prescribe its full range of uses is impossible" (p. 177). WBI is recommended since it can be used to present problems that have “vaguely defined or unclear goals, unstated constraints, multiple solutions or pathways to arrive at solutions, no consensual agreement on the appropriate solution, and multiple criteria for evaluating solutions” (p.122, Jonassen, in press b, as cited in Jonassen et al., 1997).

There is a gap in the occupational therapy literature in particular (and a paucity in other health disciplines as well) in that web-based case studies are not well described and analyzed. This is especially true in the area of clinical reasoning. It is unclear whether or not by developing a series of "good" web-based case studies that capitalize of the advantages available on the Web, students in OT (or other health professions) can not only demonstrate their abilities in clinical reasoning but also improve them.

**Summary**

This chapter has described forms of clinical reasoning used in occupational therapy, trends in teaching clinical reasoning and features of “good” case studies as teaching tools. It is widely accepted that case studies are the optimal tool to teach clinical reasoning in an academic setting. It is also becoming increasingly common to incorporate computer-based instruction, including use of the WWW, into university curricula. However, there are gaps in the research, including the occupational therapy literature, regarding how web-based instruction using case studies can be used effectively together to examine clinical reasoning skills among students in the health professions.

A series of web-based case studies was developed to investigate the forms of clinical reasoning used by occupational therapy students when they explain and justify their decisions, what web tools/resources are utilized, and the students preference of case study type (web-based or traditional). The underlying conceptual framework that structures the learning process built into these case studies and the methodology for this study will be discussed in detail in Chapter Three.
CHAPTER THREE: METHODOLOGY

Conceptual Considerations

The conceptual framework for this research project is constructivism. It forms the basis of my epistemology of learning and subsequently for the designs of the case studies used in this study. Constructivists believe that there is no universal reality. Knowledge is not "out there" to be discovered; it is created by each person woven through his/her culture, religion, education, and relationships in a number of different contexts. "[C]ontrary to common-sense, there is no unique 'real world' that pre-exists and is independent of human mental activity and human symbolic language" (Bruner, 1986 p. 95). Experience drives knowledge and understanding. Within my multiple practices as an occupational therapist, student/researcher and as an educator, I find that my position inside the constructivist paradigm varies. As an educator in occupational therapy practice, I locate myself within a sociocultural perspective in which cultural tools and symbols become internalized and used as cultural thinking tools (Vygotsky, 1978). As a clinical therapist and student/researcher, I am more closely aligned with radical constructivism (von Glasersfeld, 1991) which includes an emergent approach as described by Cobb and Yackel (1996). Here, "radical" refers to seeing the mind as influencing rather than storing and retrieving information and symbols (Schwandt, 1994). These perspectives and where I situate myself within them are reviewed below.

Constructivist Learning Theories

Sociocultural Constructivism

"Any higher mental function was external and social before it was internal" (Vygotsky, 1960, p. 197 as cited in Cobb & Yackel, 1996). Sociocultural constructivists view learning as being socially constructed, validated, and communicated through enculturation rather than by discovery. Students appropriate culturally established practices through interactions with instructors and more advanced peers. Guidance in these practices is gradually withdrawn as students become increasingly able to perform without assistance (Vygotsky, 1978). "Knowledge is both symbolic in nature and socially negotiated." (Driver, Asoko, Leach, Mortimer, & Scott, 1994, p. 5). Thus, as an
instructor in occupational therapy, I used its historical development as well as the present theories, tools and methods to inculcate students in the ways of knowing of the profession. The evolving nature of the discipline is reflected through interaction, discussion and negotiation within the profession (including our clients), changes in other health care professions and in societies at large. The students incorporate their experience (e.g. prior learning in school, insights into the health care system), beliefs and values to question, examine, challenge and negotiate with their instructors and peers regarding issues of "best" practice.

While sociocultural constructivism fits with regard to my teaching, there is a poorer fit with my research project. In this study I am less focused on how learning occurs socially in the classroom and am more interested in how individual students explain and justify their clinical reasoning, (students preferences of learning format - web versus paper-based cases, and to the extent that they take advantage of the features/resources associated with the technology). As such, I am highlighting the individual's conceptions, expression and impressions of his/her own understanding. Given this focus, a radical constructivist approach is more appropriate.

**Radical Constructivism**

Within radical constructivism, knowledge is something that tells us about experiences and the best ways to organize them (Schwandt, 1994). Knowledge is, according to von Glasersfeld (1991), "... to possess ways and means of acting and thinking that allow one to attain the goals one happens to have chosen" (p. 16). He promotes the belief that an individual learner constructs schema (conceptualizations of associated situations and actions that lead to predicted outcomes) that are altered when new information does not lead to the expected outcome. Learning occurs as the person decides whether the new information is correct (and in what contexts) or not. Progressing from more accessible to complicated concepts facilitates the development of more schemas and a greater complexity of links between them. Ideas are shared and negotiated with others, albeit incompletely, to see how closely these conceptualizations match. As more conceptualizations are developed, altered, and elaborated upon, the person has a wider range of existing options for potential use in problem solving in
various contexts. Cobb & Yackel (1996) purport that neither this individual constructivist nor the sociocultural perspective takes precedence over the other; they are reflexively related. Each is a necessary consideration in the development of students' learning.

The case studies used in this research were designed to help each student reflect on his/her ways and means of thinking and acting related to specific scenarios. Embedded within the cases is the sociocultural nature of occupational therapy practice as outlined above. For example, participants are asked to use OT theories to guide decision-making and use assessment tools and methods common to OT practice. (See Appendices A, B and C for excerpts from the three case studies.) For occupational therapy students a primary goal is to learn the content and its application to service delivery in order to practice competently. The students' explanations and justifications of their decision making are based on their conceptualizations of "best" practice in various contexts. Their explanations and justifications relate to forms of clinical reasoning used in occupational therapy. "The reasons why a student operates in a certain way are far more indicative of the student's stage of conceptual development than whether or not these operations lead to a result that the teacher finds acceptable" (von Glasersfeld, 1991, p. 98). These reasons and explanations regarding the purpose of the knowledge may also indicate whether the students are using superficial or deep approaches to learning (Marton, Beaty, & Dall’Alba, 1993). My intent was that these explanations and justifications would provide important clues as to the usefulness of these web-based case studies to help students reflect on and improve their clinical reasoning, and for teachers to improve curricula and teaching practices.

When Cobb and Yackel's (1996) emergent perspective is used to guide research, these authors propose that its sociocultural factors be included in the design. Thus, the participants and researcher negotiate meanings from the data collected. “The focus is on patterns and regularities in their interactions and on the consensual meanings that emerge between them rather than on the student’s personal interpretations” (ibid, p. 184). In my research design no such negotiation is incorporated. The content of the students' text entries was matched (using key concepts) to forms of clinical reasoning described in Chapter Two in order to identify which forms of clinical reasoning are used
(or not). At this stage of investigation a methodology fitting with the sociological or emergent perspective described above would be premature. Further research, e.g. delving into the depth and breadth of students’ clinical reasoning, would be well suited to a design through which consensual meanings concerning issues of "best" practice emerge. Implications of this study for future research are discussed in Chapter Five.

**Linking Constructivism with a Series of Web-Based Case Studies**

Building conceptualizations through a series of case scenarios requiring reflection on clinical decision making in specific contexts is a useful way to prepare students to use these conceptualizations later in practical fieldwork placements (Robertson, 1996). “Multimedia simulations afford an intermediary step for applying knowledge and skills through ...scenarios where learners must seek information, modify pre-existing concepts, and utilize knowledge and skills in new ways” (Fitzgerald, Wilson, & Semrau, 1997, p. 48). The series of case studies, designed for use in this study, was intended to bridge the gap between classroom learning and clinical practice in occupational therapy within a variety of clinical contexts. The students have the advantage (over traditional paper case studies) of getting data/further information based on their choice of action at each step in the assessment process.

The cases were designed to access specific forms of clinical reasoning used in occupational therapy (see Chapter Two). They focus on aspects of client assessment. I created this series of case studies for students in their third year of the Occupational Therapy program at the University of British Columbia so that specific content from the curriculum was incorporated into the cases. Thus the learners would work from familiar conceptualizations of knowledge applied to novel scenarios.

Reflection can be facilitated by instructors asking questions to stimulate thinking and focus observations and by providing organizing frameworks for information and ideas (Smith & Irby, 1997). Students need to build bridges from the reporting of facts and data to their use as evidence for hypotheses across subject areas towards a more global understanding. Robertson (1996) found that second year occupational therapy students identified elements of the data but did not link them, while third year students made connections between elements of the data but could not articulate the relationships
between the problem and the goal clearly. Clinicians were able to justify and elaborate on the links and relationships.

Learner autonomy can be fostered by decreasing the amount of immediate support and feedback provided, and by encouraging reflection on one’s learning. Experts modelling competent clinical practice and also explaining their thought processes, including what is unknown or uncertain, will help the student be better able to reflect critically on his/her own learning (Neistadt, 1996; Smith & Irby, 1997). Intrinsic motivation relates to learning sought for personal satisfaction. It is facilitated by giving the learner some control in the learning process, being respectful to the learners, and by making that content relevant to the learners. “…[U]sing problem solving scenarios where students are able to elaborate on situations they have been involved in draws on the internal state of individuals, that is, not only on their experience but on their motivation…a key factor in stimulating the use of deeper reasoning processes” (Gagne, 1985 as cited in Robertson, 1996, p. 215).

The paradox identified by Marton and Saljo (1984) is that if there is a predictable structure identified to promote deep approaches to learning, students focus on this structure rather than deriving meaning from the task and thus a superficial approach to learning is used. Gihooly (as cited in Hagedorn, 1996) and Raidl et al. (1995) found that novices gather excessive amounts of information and place too much emphasis on extraneous data in problem solving as opposed to experts who use schema (as described earlier). The latter authors also identify student difficulties in evaluating data. If complex cases are introduced too early, learners can be overwhelmed and feel less confident about managing service delivery (Raidl et al., 1995; Smith & Irby, 1997).

The components of constructivist theories that are essential to incorporate into the web-based case studies are:

- proceeding from simple to complex cases
- giving the learner some control in the learning process
- testing insights drawn from the learner’s experiences
- asking questions to stimulate thinking and focus observations
- providing organizing frameworks for information and ideas
- decreasing the amount of immediate support and feedback provided
- reflection on clinical decision making in specific contexts
Structure of the Cases

In all of the three case studies students were given a short clinical database introducing the client and the presenting problem(s) such as they would receive in a referral to occupational therapy services. Next, a question was posed. The case then proceeded based on the student’s choice of responses provided so that further information was presented in an authentic manner. The choices, validated by clinical experts, represent a range of possible responses (including “best” practice, “acceptable” practice and common errors made by students). The case studies were graded in the amount, type and frequency of guidance made available to the student (scaffolding) while maintaining the complexities existing in practice. The last case made the highest demands for sophisticated decision making with delayed opportunities to check with expert models and more opportunities to make alternative choices. Tutorials were presented in Learning Issues sections that were included in order to model questioning to guide clinical decision making while still requiring the student to develop a solution independently. Examples of responses from clinical experts were provided should a student choose to view them for feedback/comparison with his/her answer. Each student was asked to provide reasons for the choices made throughout each case study. At the end of each case study the student was asked how it affected his/her learning. By using processes and content that simulates actual practice, modelling and scaffolding, students are supported to use their knowledge and experience in problem solving. Examples of tasks within the series of case studies incorporating constructivist principles are to:

- complete an assessment battery based on a scenario and on test results given with each assessment
- draw conclusions based on the results of a given assessment
- identify a likely cause of a described dysfunction, and formulate an hypothesis as to why it might be so
- write a brief scenario describing a possible outcome for the choice made and the sequelae for the patient, the occupational therapist, and for the team.

Research Method

This investigation used case study as a research method. However, “there is little consensus on what constitutes a case study or how this type of research is done” (Merriam, 1998, p. 26). Case study research has been defined by the process of
investigation (Yin, 1994), the unit of study -- the case (Stake, 1994) and by its end product (Merriam, ibid; Wolcott, 1992 as cited in Merriam, ibid). It can be described by its characteristics, knowledge claims, and purposes/intent.

Case studies described by their characteristics have been categorized as particularistic, descriptive, and heuristic (Merriam, 1998). Merriam uses Olson’s (1982) “aspects” of the nature of case studies to describe these categories as follows. Particularistic case studies examine a particular situation, event, program or phenomenon. They can suggest what (not) to do given a similar situation and illustrate a general problem. My study would be characterized as particularistic case study research. Descriptive cases provide a “thick” description of a phenomenon with the interaction of multiple variables. They show how the issue is affected over time and from a variety of perspectives. Differences of opinion are identified and analyzed regarding their influence on the result. Through heuristic cases new meanings, relationships between variables, or understanding of an issue are presented/expanded upon. They can be used to explain why an innovation worked or did not, or to discuss and evaluate alternatives not chosen. They evaluate, summarize, and conclude to increase potential applicability.

Case studies have been described by their "overall intent of the study" (Merriam 1998, p.38). The term “descriptive” is used for case study research with the purpose of presenting information that will serve as a database for future comparison and theory building. Theory or the formation of general hypotheses does not drive this type of case study (ibid). Interpretive case studies use inductive analysis of data to develop conceptual categories or investigate theoretical assumptions held before conducting the research (ibid). As the name suggests, evaluative case studies are used to judge the data and issue(s) through a rich, contextually based investigation (ibid). In regard to my research, this categorization is the least applicable; “evaluative” is the closest fit.

Stake (1994) identifies three types and purposes of using case study as a research method: (a) intrinsic, in order to seek a better understanding of this one particular case; (b) instrumental, when particular case is examined to provide insight into an issue or refinement of theory; and (c) collective, when a number of cases are reviewed jointly in order to inquire into the phenomenon, population, or general condition. In this study, the
students' responses were analyzed to probe the phenomenon of clinical reasoning. As such, these are intrinsic case studies.

Stake (1981 as cited in Merriam, 1998 pp.31-32) differentiates knowledge gained through case study research from knowledge gained by other methods. The former is more concrete, contextual, developed by reader interpretation, and more based on reference populations determined by the reader.

The case study offers a means of investigating complex social units consisting of multiple variables of potential importance in understanding the phenomenon. Anchored in real-life situations, the case study results in a rich and holistic account of a phenomenon. It offers insights and illuminates meanings that expand its readers' experiences. These insights can be construed as tentative hypotheses that help structure future research; hence, case study plays an important role in advancing a field’s knowledge base. Because of its strengths, case study is a particularly appealing design for applied fields of study such an education. Educational processes, problems, and programs can be examined to bring about understanding that in turn can effect and perhaps even improve practice (Merriam, 1998, p. 41).

Stake (1994) identifies major responsibilities of the qualitative case researcher. They are:

- bounding the case, conceptualizing the object of study
- selecting phenomena, themes, or issues—that is, the research questions—to emphasize
- seeking patterns of data to develop the issues
- triangulating key observations and bases for interpretation
- selecting alternative interpretations to pursue
- developing assertions or generalizations about the case

The description of my research project below includes these responsibilities in the design of the study.

Description of the Study

The Web Site

The series of case studies used for this study is located at http://homebrew.cs.ubc.ca:8900/ WebCT Course Listings, Health Sciences, RSOT 312 Tests and Measures in Occupational Therapy. (Note: it was made clear to the students
that this study was in no way connected to the course of the same name taken by them.) Participation in (or withdrawal from) this study would have no bearing on the students' grade in their course. A guest account to access this site can be requested at sandrale@interchange.ubc.ca. The web-site is platform independent and can be accessed from any computer hooked up to the Internet. Two such computers were available to the OT students in a computer lab housed within the SRS. See Appendices A, B and C for excerpts from the three case studies.

The Cases

Three different case studies comprise the series. See Appendices A, B and C for excerpts from each one. The first case study (orthopaedics) presents an elderly gentleman who just underwent a total knee replacement. There is a referral to OT given and the student needs to decide what to do next. The participants are asked to describe a scenario that results based on the results of a clinical choice made and then to identify the consequences of that choice for the client, the therapist, and the team. This case is designed to access procedural and pragmatic reasoning, schematic processing and hermeneutics through these tasks (see Table 1).

Table 2. Case Study Descriptions

<table>
<thead>
<tr>
<th></th>
<th>1st Case Study</th>
<th>2nd Case Study</th>
<th>3rd Case Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>Elderly Man - Timothy O'Brian</td>
<td>Young Woman - Stephanie Lawton</td>
<td>Maria - 8 years old -</td>
</tr>
<tr>
<td>Area of Therapy</td>
<td>Orthopaedics - Knee Replacement</td>
<td>Soft Tissue Injury</td>
<td>Paediatrics - Neurology</td>
</tr>
<tr>
<td>Case Design</td>
<td>Scenario and Consequences</td>
<td>Prescribed Pathway</td>
<td>Relative Freedom of Movement</td>
</tr>
<tr>
<td>Guidance</td>
<td>Not offered</td>
<td>Offered after a question in posed</td>
<td>Not offered</td>
</tr>
<tr>
<td>Feedback</td>
<td>Follows participant's response</td>
<td>Offered following participant's response</td>
<td>Offered at the end of the case study</td>
</tr>
</tbody>
</table>

The second case study involves a woman who sustained soft tissue injuries from a car accident. The setting is an OT working in private practice. The participant progresses through the case by selecting the response that represents "best practice". The last case study is of a girl returning to her home community after treatment for
neurological damage sustained in a car accident. The participant completes this case study with relatively free movement and delayed feedback and few opportunities for guidance. Both of these cases are designed to access each form of clinical reasoning. See Table 2. below for a summary of the different aspects of the case studies.

**Case Study Validation**

Two clinical experts validated the content of each of the three case studies in that area of OT practice. A clinical expert was defined as an OT with a minimum of 10 years of practice in the area of therapy involved (orthopaedics, soft tissue injuries and paediatrics) who was also identified by the Clinical Fieldwork Co-ordinator in the SRS as having expertise as a clinician and student mentor. All six therapists asked to review the cases agreed to participate and were given honoraria. They were asked to review the cases in light of the authenticity of the cases to actual practice including the information in the data base, assessment tools used, assessment results provided, sequence of events presented and feedback examples given. Their suggestions to improve authenticity were incorporated into the case studies. These reviewers also gave feedback as to the "user-friendliness" of each case study (e.g. clarity of the writing and usefulness of the hotlinks) which were used to improve the cases.

In order to achieve agreement about the forms of clinical reasoning identified from the students' text boxes, a second evaluator, an occupational therapist not familiar with the forms of clinical reasoning, was asked to evaluate some of the data. She reviewed two students' data from the first case study (with all identifiers removed to preserve participant confidentiality). The data chosen were from the first students to complete the case studies one and two. The second evaluator was provided with Table 1. to help her identify the types of clinical reasoning evident in the data. There was agreement between the two evaluators except for several instances where schematic processing and procedural reasoning were interchanged. Upon discussion, it was agreed that the students must refer the influence of past learning on their present decisions in order for schematic processing to be identified. The second evaluator asked for clarification about hermeneutics, conditional reasoning and the differences between narrative and interactive reasoning. I provided explanations based on the definitions in
Table 1, along with several clinical examples (not from the data). Both evaluators then reviewed the two students' data from the second case study and agreed on the forms of clinical reasoning identified.

Validity was enhanced further by triangulation of data collection methods - using the students' original text entries (from the cases and the on-line interview) for analysis, tracking page pathways and times spent on each page, and forms of clinical reasoning described in the literature.

Participants

All third and fourth year students (36 per year) from the Occupational Therapy Division of the School of Rehabilitation Sciences (SRS) at UBC in October 1999 were invited to participate in the study. These students completed introductory courses on occupational therapy theories and practice that form the basis for the case studies. They also were familiar with web-based instruction using WebCT from a past course in the SRS. Five students completed the case studies and the on-line interview. The sixth student withdrew from the study due to technical difficulties using computers in the SRS and due to personal time/workload constraints.

Procedures

The students (all in third year) volunteered to complete all three case studies, in one or more sessions as their schedules permitted, by December 20, 1999. Only three students had logged-on by this deadline and none had completed the case studies. Two further extensions were given to allow the students to complete the three cases and the on-line interview. The five participants completed the study by the end of February 2000. All students were given three case studies to complete with no other time limit imposed. The cases required multiple choice and text entry responses.

The text entries were submitted to me via e-mail using Javascript text boxes. The students' progression through the cases and times spent on each page were monitored using the page tracking feature in WebCT. I contacted two students by e-mail who did not finish two separate case studies to ensure they realized that the cases were incomplete. Once all three case studies were complete each student contacted me in
order to set up a concluding on-line interview. These were conducted via WebCT’s Chat Room. See Appendix D for questions guiding the on-line semi-structured interview.

**Evaluation**

Students’ use of the web options (e.g. tutorials, web searches, and comparisons of their responses to an expert’s model) were tracked by WebCT as above. The data from the text boxes were evaluated using key concept words comprising the various types of clinical reasoning (see Table 1.) used in occupational therapy to determine the forms of clinical reasoning used by each student. Data from text boxes in the cases also described the sources of knowledge used (e.g. theories of practice, theories of clinical reasoning, experience, or authorized sources of knowledge such as instructors, textbooks, or clinicians). Information gained from the students’ e-mails was used to clarify the wording in, and use of, the case studies. In the on-line interviews (see Appendix D), the participants were asked to evaluate the usefulness of the cases in promoting reflection into their clinical reasoning, identify any sites accessed on the WWW, and to state their preference between web-based and paper-based case studies. My findings and analysis are discussed in Chapter Four.

**Summary**

Five students from the third year class in Occupational Therapy in the School of Rehabilitation Sciences at UBC participated in this research project. A particularistic case study was the research method implemented. The students completed a series of three web-based case studies based on constructivist learning theories (Vygotsky, 1978; von Glasersfeld, 1991; Cobb & Yackel, 1996). This series was designed so that students could apply knowledge gained from the OT curriculum and personal experience to novel clinical scenarios. The explanations and justifications of their clinical reasoning were compared to forms of clinical reasoning used in occupational therapy practice. The results of the study are discussed in Chapter Four.
CHAPTER FOUR: RESULTS

Five students completed the series of three web-based case studies and an on-line semi-structured interview. The results of the data are described below with respect to the forms of clinical reasoning (CR) evident, the sources of knowledge identified by the students, and the students' (S) preferences for web-based versus traditional (paper-based) case studies.

Forms of Clinical Reasoning Evident

The forms of CR most commonly used were procedural and interactive reasoning (Fleming, 1991), pragmatic reasoning (Mattingly & Fleming, 1994) and schematic processing (Elstein, 1979; Gagne, 1985). Procedural reasoning was the most often used form used overall. Diagnostic (Rogers & Holm, 1991) and narrative reasoning (Schell & Cervero, 1993; Mattingly & Fleming, 1994) and hermeneutics (Dilthey, 1900 as cited in Kelly 1996) were forms infrequently used. These forms of CR were used in each of the three web-based case studies but not by all of the participants. Conditional reasoning (Fleming, 1991) was the least used form; it was used only by two of the five students and only in the Paediatric Case Study. See Table 3. for an overview of the frequency of evidence for each form of clinical reasoning per case study. The frequencies of key words/phrases representing the various forms of CR are grouped to better display trends.

Table 3. Frequency of Evidence of each Form of Clinical Reasoning Per Case Study

<table>
<thead>
<tr>
<th>Form of CR</th>
<th>Knee Replacement</th>
<th>Soft Tissue Injury</th>
<th>Paediatric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural Reasoning</td>
<td>13+</td>
<td>13+</td>
<td>13+</td>
</tr>
<tr>
<td>Interactive Reasoning</td>
<td>10-12</td>
<td>7-9</td>
<td>4-6</td>
</tr>
<tr>
<td>Schematic Processing</td>
<td>7-9</td>
<td>13 +</td>
<td>7-9</td>
</tr>
<tr>
<td>Conditional Reasoning</td>
<td>0</td>
<td>0</td>
<td>4-6</td>
</tr>
<tr>
<td>Diagnostic Reasoning</td>
<td>0</td>
<td>7-9</td>
<td>4-6</td>
</tr>
<tr>
<td>Narrative Reasoning</td>
<td>1-3</td>
<td>1-3</td>
<td>1-3</td>
</tr>
<tr>
<td>Pragmatic Reasoning</td>
<td>10-12</td>
<td>10-12</td>
<td>4-6</td>
</tr>
<tr>
<td>Hermeneutics</td>
<td>1-3</td>
<td>4-6</td>
<td>4-6</td>
</tr>
</tbody>
</table>
Tables 4-6. show the forms of CR in evidence by each student in each separate case study. Conditional and diagnostic reasoning were not apparent in the Total Knee Replacement Case Study; narrative reasoning and hermeneutics were used only by one student each. In the Soft Tissue Case Study all five students used procedural and interactive reasoning and schematic processing. None used conditional reasoning. Of note, S 3 used only the above mentioned forms of CR to complete this case study. In the Paediatric Case Study one student employed five of the forms of CR, two students: six, and the other two participants: seven. No student used all forms of CR; all forms were used between the various participants. The information from these tables provides an indication of what forms of CR are facilitated by the different designs of the case studies. This will be discussed more in Chapter Five.

Together Tables 4-6. display the range of forms of clinical reasoning used by each student in total. Each student used all the forms of CR described over the three case studies except only S 2 and 3 showed evidence of conditional reasoning (and only in the Paediatric Case Study). Absences (or infrequent usage) of forms of CR by a particular student may have implications for teaching practices. This will also be considered further in Chapter Five.

Table 4. Forms of Clinical Reasoning Evident Per Student: Total Knee Replacement Case Study

<table>
<thead>
<tr>
<th>Form of CR</th>
<th>S 1</th>
<th>S 2</th>
<th>S 3</th>
<th>S 4</th>
<th>S 5</th>
</tr>
</thead>
<tbody>
<tr>
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<td>yes</td>
</tr>
<tr>
<td>Interactive</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Schematic</td>
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<td>yes</td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Conditional</td>
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<td>no</td>
<td>no</td>
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</tr>
<tr>
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<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Narrative</td>
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<td>no</td>
<td>no</td>
</tr>
<tr>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Hermeneutics</td>
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</tbody>
</table>
Table 5. Forms of Clinical Reasoning Evident Per Student: Soft Tissue Injury Case Study

<table>
<thead>
<tr>
<th>Form of CR</th>
<th>S 1</th>
<th>S 2</th>
<th>S 3</th>
<th>S 4</th>
<th>S 5</th>
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</thead>
<tbody>
<tr>
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<td>yes</td>
</tr>
<tr>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Conditional</td>
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<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Diagnostic</td>
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<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
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<td>no</td>
<td>no</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
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<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Hermeneutics</td>
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<td>no</td>
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<td>no</td>
</tr>
</tbody>
</table>

Table 6. Forms of Clinical Reasoning Evident Per Student: Paediatric Case Study

<table>
<thead>
<tr>
<th>Form of CR</th>
<th>S 1</th>
<th>S 2</th>
<th>S 3</th>
<th>S 4</th>
<th>S 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Interactive</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Schematic</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Conditional</td>
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<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Narrative</td>
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<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Pragmatic</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
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</tr>
<tr>
<td>Hermeneutics</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

Procedural Reasoning

Procedural reasoning involves hypothesis generation and testing about a client's disability. The student/clinician uses the evaluation, treatment methods and tools of his/her discipline, in this case occupational therapy (Fleming, 1991). S 2 gives evidence of this form of CR in the case study of a man who underwent a total knee replacement:

I would ensure that the client had the appropriate aids and knew how to use them. For example a long handled reacher, sock aid and shoe horn would allow him to put on socks, shoes, pants etc. In addition I would talk to the client to ensure that the proper equipment was in place at home to increase safety (ie [sic] grab bars, shower chair/stool) and that he was aware of safe transfer techniques. Note: these issues may have been addressed pre-op with the client, in which case it would be a quick check to make sure everything is in order . . .

Here, S 2 anticipates the patient's limited knee bending (leading to an inability to reach his feet) and mobility. She suggests tools and methods of compensating for these
problems. However, the "testing" aspect of procedural reasoning is not addressed showing an incomplete use and/or explanation of this form of CR. Issues of breadth, depth and "correctness" of the students' CR will be discussed Chapter Five.

Interactive Reasoning

Interactive reasoning (Fleming, 1991) deals with creating a therapeutic relationship; information is gathered about the person and the effects of the presenting problem on him/her.

Although the doctor's referral is to work on mobility and gait, doing an initial interview would be helpful to determine any other concerns he is having regarding his knee replacement and his feelings on how the knee replacement will impact and change his life. I think doing an initial interview would be helpful in determining his goals and the ones that are the most important to him. S 3.

In the previous example, S 2 also talked to the patient, however the purpose was clearly different. She alluded to problems and identified ways to address them. In this instance, S 3 states that the intent of the interview is to identify the patient's concerns, feelings, and goals post total knee replacement surgery: the focus of interactive reasoning. S 4 provides another example of this form of reasoning in respect to the last case study-- a child with an acquired brain injury:

I think this assessment tool enables me to develop a rapport with the client and her care-giver by enabling us to talk and spend some time getting to know each other [sic]. Also, it helps me see how the client views her present performance, and suggests areas they would like to work on.

Schematic Processing

S 4 also gives a clear example of schematic processing in respect to the second case study-- a woman with a soft tissue injury following a motor vehicle accident, when she explains why she choose to do a particular interview with "her client".

Also, during placement I really saw that when some clients aren't getting their needs met or enough attention in one area, they project this onto other areas of life. So I wanted to find out if she was having any problems in any other meaningful activities that was making it harder for her to return to work.
When schematic processing (Elstein, 1979; Gagne, 1985) is utilized, conceptualizations from past learning are used to compare present scenarios to past ones. The conceptualizations are modified when new information does not fit the existing ones. It seems that in the example above S 4 has not found it necessary to modify the conceptualization she has formed.

Conditional Reasoning

Conditional reasoning (Fleming, 1991) incorporates the ongoing reassessment and revision of the treatment plan based on the client’s present, and anticipated future, needs and goals. This form of reasoning was rarely in evidence in the students' responses. Their answers mostly concentrated on present and past levels of function. Consideration was frequently given to clients' goals for the future but seldom to planning for future change in assessment and treatment strategies. Future needs and goals were accounted for procedurally (e.g. by recommending equipment for a client's safety at home post discharge from hospital). S 2 indicates conditional reasoning when she described why she chose to work on the child's goal to play skipping games.

- the use of games can be used to work on using the right side of her body again. Activities could be graded and/or adapted as she progresses, with the ultimate goal of her being able to play the skipping games she loves so much. This may serve as a form of motivation for Maria, and the results will carry over to many other daily functions and skills.

While S 2 does not describe the activities or explain how they could be graded, she does acknowledge that skipping may be the "ultimate" goal but that the activities need to be graded in difficulty until the client has the prerequisite skills necessary to meet that goal. S 2's intention to modify the treatment plan as able is clear. She is also aware that treatment for one goal may have wider implications for other areas of function.
Diagnostic Reasoning

Diagnostic reasoning (Rogers & Holm, 1991) uses differential diagnosis – identifying the possible causes of a problem and determining the most probable one in order to arrive at a corresponding intervention.

It is possible that Maria’s vision is fine but that her brain is misinterpreting what the eyes are telling it. An indication for this is her reversibility. If only her vision acuity was impaired than is isn’t probably that she would have reversibility issues. ...If Maria’s impairment is in visual perception, as I suspect it is, than this will have an impact on all aspects of her life. These include reading, feeding, dressing, and any play which requires visual cues. It will be important in my treatment to not assume that Maria sees these cues but to remind her to seek them out. S 1.

In the above quote, S 1 has tried to hypothesize what has and has not contributed to the client’s difficulties with written communication post acquired brain injury. While she has given a justification (albeit a limited one) for visual acuity not being the problem, she has not given any explanation of why visual perception is the reason for the impairment. Her association of the problem to a corresponding treatment is non-specific and further probing into S 1’s understanding on the concepts and their application is required.

S 4 describes the need for further assessment to identify possible limiting factors to the client’s function in the second case study:

self-care is the largest area in which she is having problems, and it seems like it has to be done, but it is still causing her lots of pain and discomfort. I would want to do a more indepth assessment because I don’t have a clear picture as to what is causing her difficulties and pain.(I would want to do an activities analysis and perhaps a functional assessment) Also, I feel as though sleep falls in the category of self-care, and since it is the first priority listed, I feel that this area should be addressed ASAP. ...Readings we have done in 207 about finding the components that are contributing to OPI’s [occupational performance issues]--when I see this client’s list of OPI’s I don’t see a clear picture as to what is contributing to her pain and her difficulties even getting going...therefore, I need more info in this area.
Although the "differential" aspect of diagnostic reasoning was not outlined in the above text, it is stated that S 4 thought that further assessment was necessary to identify which components of function were contributing to the clients deficits (and by implication those that were not contributing).

Narrative Reasoning

Narrative reasoning (Schell & Cervero, 1993; Mattingly & Fleming, 1994) involves a client sharing a personal reflection of one's story - past, present, and imagined future. Patterns of behaviour and thinking that affect performance in daily activities are identified and used by the health professional and client to plan for desired change.

Therefore, if I listen to Stephanie's concerns about all areas of her life, than I can get a sense of what is important to her, and what kind of person she is. I would probably use CMOP [model of occupational therapy] to Guide [sic] me because it really enables me to hear what is important to my client, as well as hear her priorities and find out about various aspects of her life. Also, perhaps other important issues in self-care or leisure are contributing to her continued absence from work, and if these issues are addressed than maybe it will enable her to return to work. For this reason, I wouldn't want to focus too much on her return to work, and I would want to listen to her talk about the other important areas of her life. S 4.

Phrases such as, "what kind of person she is", "hear her priorities and find out about various aspects of her life" and "perhaps other important issues in self-care or leisure are contributing" (although imprecise) indicate that narrative reasoning is being used/developed.

Pragmatic Reasoning

Pragmatic reasoning (Mattingly & Fleming, 1994) considers the assets and limitations put on assessment and intervention based on personal, environmental, socio-economic, and institutional factors.

All of the goals I have chosen can be easily reinforced and carried out at home. Her parents can supervise and help with the handwriting, her siblings and peers may skip rope with her, and dressing is done several times a day (clothes, pyjamas). Her mother can be shown how to encourage her to do it as much as possible on her own and what she will need the most help with. S 5.
S 5 has taken personal and institutional factors into consideration in the above example. She identifies that she as the occupational therapist is not the only person involved with carrying out the therapy and that it may occur in several venues (e.g. home and school).

S 2 is addressing institutional factors when she asks the following question:

What is the insurance company's role in determining priorities for assessment? -this is important to consider because in this case the insurance company is paying for OT services -the insurance company specified their goal is to have the client return to work as soon as possible-this influences priorities of assessment Work is one of the top OPIs identified by Stephanie. Also, return to work is the target of the insurance company, which is paying for OT services.

Hermeneutics

Hermeneutics is the process of interpretation moving back and forth between the whole and its parts. It is used to establish an "appropriate" understanding of human experiences through text and other expressions (Dilthey, 1900 as cited in Kelly, 1996).

A student, in the quotation below, shows evidence of hermeneutics when she chooses a goal to work on with her client.

reading at a grade 1 level: I chose this because her parents rank this as most important and their satisfaction with her performance is 1. I also think that Maria will enjoy reading because she had high marks in language arts before, and during recovery she kept in touch with friends by reading and writing letters. By reading she will be able to see an example of proper spacing, lettering, and size. This will hopefully transfer when she starts writing so she doesn't make as many of those sorts of mistakes. I chose reading instead of writing because she is easily distracted and frustrated, so if she spends too much time either looking for the key stroke on a computer or writing a word down she may not want to continue any longer. Writing may also be easier for her later as she gains more fine motor control by going to physio. Reading also stimulates Maria cognitively and perhaps stimulate her imagination. S 3.

S 3 looks at "the parts": Maria's problems with spacing, formation of letters and size; distractibility; and frustration and fits them in with a larger "whole" in the child's life including her past and present interests, her parents' choices, future needs (writing -- by hand or computer) and motivation. S 3 is searching the links between the whole and
the parts as they relate to Maria and her progress in functional activity. (Elements in the
text concerning the client's transfer of learning also indicate a need for further
instruction regarding "appropriate" treatment.)

Sources of Knowledge Identified by the Students

All the students predominantly identified information gathered from courses,
including models of occupational therapy practice, in the occupational therapy
curriculum as their sources of knowledge. Commonly authorities were cited --
clinicians/clinical placements (four students) and resources, e.g. books and manuals (two
students). One student cited a built-in link to the BCSOT web site. One individual
identified the source as her "own personal experience and knowledge" and another
person listed "common sense". No students discussed the content (practice issues) with
each other.

All of the students compared their choice of responses with the expert models
provided. Several of the students also reviewed the model provided based on other
choices after submitting their own choice. On occasion, a student reviewed a model
before submitting her own choice. Three of the participants availed themselves of the
other hot links built into the case studies. The following links (by number of students)
were used - Learning Issues/tutorial (2), other information links within the case study
(1), hot links to specified sites on the WWW (1), internet searches (0). One of the five
students reported that she went beyond the case studies and sought out sources of
information. In other words, the participants relied on traditional sources of information
and made little use of materials or sources available through the WWW. This is
understandable in that participation in this project was entirely voluntary and the web-
based materials were not perceived to be associated with any of the course requirements
or forms of assessment. This will be discussed further in Chapter Five.

Usefulness of the Cases to Promote Reflection into Clinical Reasoning

The participants were asked at the end of each case study, "Did this case study
help you to reflect on how you made your clinical decisions. Please provide a detailed
explanation." Several of the students answered this question by giving examples of what
they learned from the case study rather than how they learned. The examples below are from students that provided information about their reflections on their CR:

This case study [paediatric case study] helped me prioritize OPIs identified based on information gathered from the COPM. This case study helped me go through the process and reasoning behind all my choices. I think doing this activity has helped me solidify what I've learnt in my OT theory courses and given me a chance to implement some of the assessments I've learned about in RSOT312. S 3.

I found this case study [soft tissue case study] very frustrating. It was helpful to be reminded that rom [sic] and strength should be considered early in the intervention processs [sic], but I don't think I had a good picture of how Stephanie felt about her injury. This may indicate that I tried to rush through the beginning stages of my clinical reasoning and jumped into incorrect assumptions. This case study did not help me as much [sic] as the other two. S 1.

Yes it did. I didn't make the connection in my mind as to how ROM and strength could possibly be related to her bad sleep patterns, so when you asked for possible assessments, i [sic] remained more focussed on the standard Rom [sic] and strength assessments. I reminds me that i [sic] have to keep a broad perspective. S 4.

The case studies are definitely helpful in making me realize that I don't always retain the info I have learned in previous classes. Also, these case studies were helpful in allowing me to see how knowledge from my various classes needs to be brought together to ensure that my clinical reasoning is accurate and justified. Yes, this study [paediatric case study] did help me explain my clinical reasoning because it kept asking me why I was doing everything I chose to do. However, in some cases, it was difficult to explain why I chose something, because it just seemed like the answer felt right. S 4.

Students' Preferences for Web-Based vs. Traditional (Paper-Based) Case Studies

Overall, the participants varied in their preferences for web-based (WB) versus traditional (T) case studies. One student's stated preference was for the former, three for the latter, and one student was undecided. These preferences were "soft" -- usually described with qualifiers and positive and negative aspects of both formats. However, the participants' likes and dislikes were remarkably uniform based on a number of issues including case study design, "user-friendliness", and feedback considerations. Examples
of their remarks are presented below and the implications are discussed in Chapter Five.

The student who was noncommittal to a preferred format gave these reasons:

This format [WB] was fun and different, so it was a little more exciting. However, at times it was also more frustrating because I sometimes typed up a whole response to later on find out that it was wrong, and then I had to try and explain my next choices, when sometimes the only reason I picked option 2 was because the one that I had originally thought was right, was actually wrong. So, in response to your question, they both have good and bad aspects. I can't say that one is better than the other, because they both offer different kinds of learning. T's are more convenient, but I think W's are more with the Tech. times and they are really neat to do all on the web. S 3.

S 2 who preferred WB made the following comment:

I like the idea of working through cases online. However, at times it was frustrating in that your selection would lead you in a certain direction (as pre-programmed in the case study). I often felt that I had validated my answer but it didn't make a difference what my reasoning was, because it would give me an automatic response. After making adjustments to accommodate for such difficulties, I think I would prefer to be able to do case studies online.

The other students who preferred traditional (paper-based) case studies offered these explanations:

I think both methods have their merits. I appreciated the flexibility of the web-based studies and being able to get immediate feedback and updates. However, it did tend to be a bit confusing when I tried to navigate around. Overall, I still feel more comfortable with paper but I think that if I did another web-based one I would feel just as comfortable with that method. ...because you did make me think more about what feedback I preferred. I would definitely favour T over WB although the convenience of WB is great. S 1.

I thought that this approach was interesting and new but I prefer paper written because I find all the problems with computers much too frustrating. Although I suppose it would have been hard to hide the next question if they were all just on paper. Also the links were interesting as well as the immediate feedback about what our decisions would result in. I guess if the computer system was less "buggy" the computer format would be better. I still prefer paper, personally, but if I were more computer experienced or computers were more user-friendly I think it is the better method. S 5.
I prefer the T based cases because you have all the information and questions layed [sic] out in front of you so it is clear and straight forward. Sometimes [sic] I found the WB case studies to be a bit confusing because when I chose an answer that was not correct I didn't know I had to go back and choose another answer. I also found with the WB cases I had to keep going back to refer to previous pages to get information to answer the question. I liked the fact that with the WB case studies you [sic] had access to other links. …Sometimes when I want to get on to webct [sic] to work on it the line is busy or the server is down, another time the computer disconnected or froze on me so all the work I had typed out I couldn't send it in. Luckily I cut and pasted the saved it on my c-drive and sent it in the next time. S 4.

In regard to WB, there were three different designs of the cases. In the first case study, a data base and a referral to OT was given. The student then chose what he/she thought was the best response to the referral offered and wrote a scenario describing what might happen next as a result of that choice. Then the student described the anticipated consequences of that choice on the patient, occupational therapist, and on the rest of the team. The second case study involved the assessment of the client presented in a data base. Again, choices were offered to the students representing a range of possible responses. The students were given a sample result of the selected choice and were required to try another option if the choice representing "best practice" was not selected. Thus a prescribed pathway through the case was compulsory. The participants unanimously disliked the prescribed path design (as was described by S 2, 3, and 4 above) and preferred the relative freedom of movement design. This latter (third) design matched that of the second case study except that the student proceeded through the case regardless of whether or not their answer selected represented "best practice". Feedback was offered at the end of this case study.

Four of the five students liked the "immediate" feedback available in the three designs of the WB; two preferred the specificity of feedback to what they had written possible with T (as opposed to the pre-programmed responses to the given choices that were included in the WB). Two students commented that specific (personalized) feedback should be incorporated into WB. One observation was made regarding T, "However written feedback [sic] is often (in my experience) not very elaborate or specific either" S 5.
Issues identified regarding "user-friendliness" were: the inability to send text boxes from the SRS computer lab (leading to lost data), difficulty navigating between pages, unclear instructions for when to exit the cases, "freezing" on-line (leading to lost data), and inaccessibility to the server at busy times of the day. These issues caused the greatest frustration and lead to the sixth student to withdraw from the study.

Summary

Students completing the series of web-based case studies predominantly used procedural, interactive, pragmatic and schematic forms of clinical reasoning. Conditional reasoning was rarely used. The participants cited their course work in the OT program as their primary source of knowledge. Their preferences of format (web-based or traditional paper-based case studies) were "soft" -- usually described with qualifiers and positive and negative aspects of both formats. However, the participants' likes and dislikes were remarkably uniform based on a number of issues including case study design, feedback and "user-friendliness" considerations.
CHAPTER FIVE: DISCUSSION AND IMPLICATIONS

This chapter discusses the results of the study in relation to my original research questions and their implications for further research and teaching/learning. In Chapter One I asked whether or not a series of web-based case studies (WB):

1) allows students to demonstrate different forms of clinical reasoning;
2) encourages students to use the web to search for resources that support learning clinical reasoning; and
3) are perceived by students to be advantageous or preferable to paper-based cases.

Engagement in Clinical Reasoning (CR)

The participants in the study, both by their own judgement and my own, demonstrated an ability to engage in CR through the WB. The breadth and depth of CR varied in terms of the forms evident and the quality of the students' explanations and justifications. However, there were clear trends in the forms of CR used by the students. (The small number of participants in this study precludes any analysis for statistical significance.)

Forms of Clinical Reasoning

To review the results from Chapter Four, interactive, procedural (Fleming, 1991), and pragmatic reasoning (Mattingly & Fleming, 1994) and schematic processing (Elstein, 1979; Gagne, 1985) were used most frequently by all the students in each of the case studies. Hermeneutics (Dilthey, 1900 as cited in Kelly, 1996) and narrative reasoning (Schell & Cervero, 1993; Mattingly & Fleming, 1994) were used in each case study but infrequently. Diagnostic reasoning (Rogers & Holm, 1991) was occasionally used in the last two of the three case studies. Only two of the five students used conditional reasoning and only in the last (paediatric) case study.

Investigation into the reason(s) why certain forms of CR were seldom used is beyond the scope of this study. The particular forms of clinical reasoning used by the participants loosely matched the forms anticipated through the designs overall. In the first case study, the discrepancies found were that hermeneutics was seldom evident and interactive reasoning was used frequently. The main discrepancy in the other two case studies was that conditional reasoning was rarely evident. The relatively close match
between the anticipated and actual forms of clinical reasoning evident suggests that the case studies have been, by and large, well designed in this regard.

While the exact number of times each form of CR was used is not meaningful, the frequency of usage may indicate trends that have implications for teaching and further research. Those forms of CR that were used by few students or were rarely used by all the students may indicate anything from a lack of understanding of the embedded concepts to simply a lack of depth in the explanations and justifications given due to time constraints or other factors. All five of the students completing the cases and the interview stated that the project was time consuming to complete on top of their course work and other obligations; three students commented that they finished the last case with brief answers due to limited time available. They also claimed that they did not think that they would have answered the questions in any more detail if the cases were presented in a traditional paper-based format (T) rather than the WB. Further probing with the students based on the data collected is needed to determine if apparent gaps in knowledge and their application are actual gaps.

Identification of the trends in the clinical reasoning used prompts instructors to determine if the content and concepts comprising these forms of CR indicate areas of incomplete understanding among their students. Such investigation could indicate to instructors whether particular emphasis in these areas is warranted at classroom teaching and/or curriculum planning levels.

**Better Ways of Knowing**

An analysis of CR cannot be divorced from a discussion of the "correctness" of content and concepts embedded in the students' explanations and justifications. A view voiced by each of the participants in the study raises concern for me as a constructivist teacher. The students each stated that in the prescribed pathway WB that were frustrated being "told" that they were "wrong". A "wrong" choice may be more likely to be discarded in future practice than a choice seen as "possible" but not "best". Underlying a perspective of "better/best" is a willingness and a responsibility to examine a range of possible choices, investigate how each would affect the players in the given scenario,
and to select the most appropriate one(s). This perspective also reflects that what works well in one situation may or may not do so in a similar one.

Upon investigation during the on-line interview, the students acknowledged that having to pick another option in order to proceed to the next step in the case study required them to re-evaluate why another choice might be more appropriate. Yet they maintained that they did not like this process to progress through the WB. In this (the second) case study, the outcomes of the choices ranged from positive to negative; they were deemed likely results in the opinions of the clinical experts who reviewed the case studies. In several instances positive results ensued from choices other than the one that allowed the student to proceed to the next step in the case study. While there is no one way to practice occupational therapy (OT) there are better ways to do so.

Viewing the problem of "correctness" from a radical constructivist position, individual and sociocultural constructivism are reflexively related. Each student's perspective on how to address a clinical issue is based on her conceptions of the scenario presented and background knowledge and experience. The same holds true for the designer of the WB. Alongside is the enculturation of students to the ways of knowing in OT. Novices and experts reason in different ways (Hagedorn, 1996; Robertson, 1996). Educators need to facilitate learning to achieve increasingly sophisticated ways of reasoning. The validation of the content by clinical experts helps ensure that best practice in OT is reflected as closely as possible. All these considerations are necessary in the development of students' learning. Instructors can facilitate students to use their knowledge, experience, beliefs and values to question, examine, challenge and negotiate regarding issues of best practice.

Beyond these conceptual issues, there may be several design factors contributing to the students' frustrations that can be improved upon. The multiple-choice format, one often used for testing, might lead one to believe that there is a right answer. Another manner of presenting the choices can be used. The students felt that their CR was not given a chance because they were prevented from following their choice to the end of the case study. A preamble to the case describing how a "best practice" choice is used to progress through the case study would prepare the students in advance and could model the concept of "better/best" rather than "right/wrong". In the given "results" from the
choices, more explicit acknowledgements of good choices while suggestions that there is a better answer might help the students feel better about seeking another response. At several points in the case study, responses were taken as "wrong" that may have been "right" in another context. Exploration of the different perspectives and context specific issues (e.g. in an on/off-line tutorial) between peers and with the instructor would help to facilitate learning.

The ideas in the following quotation exemplify the concerns presented above.

I think that when I respond to things, I usually respond with confidence. In that case, if I'm told I'm wrong then in most cases I need to be explained why, because I had a valid argument for my original answer. S 1.

Firstly, there is the pedagogical issue of how to deal with a "wrong" answer. This student's choice is "to be explained why". The instructor's goal however may well be for the student to develop the practice of exploring a range of possible responses and to evaluate why a given response is better than another one to identify "best practice" in that instance. Then issues can be explored and contested. This perspective would need to be voiced and modelled in a given course and ideally, throughout the curriculum.

Second is the issue of a "valid argument"; the student's implied meaning is that "valid" equates with good judgement in that scenario. Just because someone can justify a decision does not mean it is based on reflection or good judgement; a person's confidence in a decision might be misplaced. A forum for discussion where ideas identified in the WB can be investigated and debated could facilitate an improvement in the breadth, depth and "correctness" of the application of students' knowledge to clinical work.

Interestingly, students did not initiate their own discussions regarding aspects of the case studies they said they found engaging (although they did talk about frustrations that arose due to technical problems or unclear instructions) with each other nor with the researcher. Two participants, in the on-line interviews, stated that they wanted a forum to discuss issues arising in the cases and most (4/5) of the students preferred feedback specific to their own work. If web-based case studies were to be used in the future, avenues for discussion, student-student and student-facilitator (on or off-line) would
need to be offered. Chat rooms, bulletin boards or e-mail are three possible multi-user on-line venues.

Searching for Resources on the Web to Support Learning

All of the participants in this study made use of the hot links embedded within the WB for feedback. Two students employed links offering additional information/tutorials but only one student, and only in one reported instance, used a hot link to a given site on the World Wide Web (WWW). None of the participants initiated a search on the WWW for resources or information. The participants unvaryingly cited a lack of time as the reason for not using the WWW. It was seen as requiring additional time and effort that the students did not feel they had available for this project as it was in addition to their graded course work.

The students used learning from their OT curriculum and fieldwork primarily to complete the three case studies. They cited models of occupational therapy (and used the language embedded within them) to guide their decisions for clinical practice. One student reported spending extra time to review physical resources she had available (e.g. textbooks, assessment manuals, and class notes). Presumably these resources were preferable as she knew the information was there. The students participating in this study have had prior experience using the WWW for course assignments. Perhaps these experiences dissuaded them from initiating their own searches. These assumptions would need to be verified with the students along with their perceptions of the quantity and quality of the resources they have found on the WWW.

From my perspective as the designer of the cases and my own searches for relevant sites/information to include as hot links, the WWW is presently useful for obtaining only certain types of information quickly. A vast number of sites relate to schools with occupational therapy programs, several sites address specific diagnoses and to client/patient perspectives on assessment and treatment options. Few relate to the theories and tools of OT, and those that do often only give brief snippets of information and/or references to items available for purchase. There are multitudes of listservs open to occupational therapists, OT students, and educators. However, one has to subscribe thus delaying the access to the information and issues discussed (but usually archived). I
was able to find at least one valuable link per case study that had a direct application/relevance to each case study that I would not have found off-line; however, the searches were very time consuming. While a given site could be saved with a bookmark often the layers within it could not be so making it cumbersome to return at a different time.

Other difficulties using the WWW occurred, including accessing the WB themselves and the Chat Room feature which were available on the web through WebCT, that may also have limited the amount of time that students wanted to spend on-line. These problems did not occur in prior tests of the WB. The primary source of frustration involved the computer lab in the School of Rehabilitation Sciences (SRS). This lab is available to students but (unbeknownst to me until the end of the study) has their access to e-mail, sending as well as receiving, removed. Therefore, students while able to access the WB could not send the information submitted in their text boxes through the computers in this lab. The information was lost and thus the students had to go to the university computer lab or use a private computer, re-enter the data, and re-submit the text boxes. This affected at least half of the participants including a student who dropped out of the study.

Another computer problem involved the WebCT tool bar for navigating in the WB. This toolbar is shown below the Internet toolbar on the computer. Each has a button to move forward or back, however they operate differently. The Internet toolbar goes back to the previously seen screen; the WebCT toolbar goes back to the previous page in a numerical sequence. Because the participant progresses through WB in a non-linear fashion, this person may never have seen that page before, making it very confusing and difficult to navigate. This happened with at least one participant.

Errors also occurred due to unclear explanations of how to proceed through the case study. Two students stopped part way through a case study without realizing that it was not finished. These errors were found through the page tracking feature in WebCT and text entry reviews, and they were corrected after the researcher contacted the participant by e-mail. One such unclear explanation in the second (Soft Tissue Injury) case study was reworded after the first student experienced the problem. Although this issue did not increase the time spent to complete the WB, it was a source of frustration.
for some of the participants possibly discouraging them from spending additional time on the WWW.

**Students Preferences between Web-based (WB) and Traditional (T) Case Studies**

Neither the WB nor the T was perceived by students to be strongly advantageous or preferable to the other. One student's stated preference was for the former, three for the latter, and one student was undecided. These preferences were "soft" -- usually described with qualifiers and positive and negative aspects of both formats.

The participants' likes and dislikes (identified during on-line interviews) were remarkably uniform based on a number of issues including case study design, "user-friendliness", and feedback considerations. As described previously, the prescribed pathway design was greatly disliked. The other two designs, and the relative freedom of movement design by their preference, were described as useful to promote reflection into their CR. User-friendliness issues were discussed above under Searching for Resources on the Web. Feedback was preferred when it was immediate and specific to the students' work.

**Better Ways of Knowing Revisited**

There is a philosophy in adult education of respecting students' choices (Knowles, 1980) and much written in the literature about learner-centred teaching/learning principles. Students commonly protest that their input in courses is sought and then ignored. In occupational therapy, client-centred practice is a central theme. If (OT) students are our "clients", then should not their choices for learning be respected? In the on-line interviews the five students voiced a singular opinion that they did not like the case study design with a prescribed pathway. They also were clear that they prefer immediate and specific feedback. Regarding this latter point, literature from cognitive psychology (Gaynor, 1981 as cited in Johnson, Cunningham, Finkelstein, & Hand, 1997) and adult education (Arseneau & Rodenburg, 1998) finds that delayed feedback is better to promote in-depth learning. This begs the question, "What should be done when students' choices do not match the research on 'best practice' in adult education"?
It is my contention that when students provide feedback to instructors, their input ought to be used to improve curricula and/or teaching practices with the proviso that it is in keeping with one's beliefs and values about teaching/learning and with research as to "best practice" in the field. Therefore, I do not advocate changing aspects of the WB that constitutes "best practice" in this context. This does not mean that there is no room for improvement based on students' feedback. Examples of how the WB can be improved were discussed earlier. They include: (a) providing a venue, as outlined above, for online or face-to-face (delayed) feedback and discussions within specified time frames; (b) re-wording instructions and feedback in the prescribed pathway to focus learners on better options rather than right/wrong choices; (c) making multiple themes and perspectives (Spiro, Vispoel, Schmitz, Samarapungavan, & Boerger, 1987) more evident; (d) continued "debugging" of the system; and (e) instituting computer technical support to the students and to the designer if possible.

Limitations of the Study

The design of this series of case studies was limited by my lack of computer technical skills and knowledge and access to the same. These skills include writing Javascript and the ability to link different software packages that might allow increased freedom to move through the cases while still permitting tracking of the movement. Also, the designs of current course authoring computer software predominantly do not facilitate user-friendly, non-linear, multifactorial case study construction. Therefore certain aspects of a "good" case study were not adequately achieved. The indications of right/wrong implied were discussed above. The sequence of questions and choices available were limited due, in part, to the need to progress through the cases to arrive at specific "results" pages and the time required to create each page. Thus the progression through the WB was more linear than intended. Although these WB were designed to address only the initial assessment phase of practice, this decision may have reduced the forms of clinical reasoning used by the participants than if client treatment planning, implementation and evaluation were included.

The possible conclusions gleaned from this study are limited due to the small number of participants in the research. Clearly the time commitment involved was too
great for the students invited to participate in this research including those who agreed to participate (given the need to extend the deadline for completion twice and by their comments in the on-line interviews). See "Implications for Further Research" below. If there would have been an ample sample size to do a quantitative analysis of the forms of CR used it would have brought greater depth of understanding to the research questions.

**Implications for Further Research**

The results of this study open up a raft of possibilities for future research. It would be beneficial to repeat this study incorporating it as a graded assignment in existing School or Rehabilitation Sciences (SRS) courses on occupational therapy assessment and clinical reasoning. This would eliminate the excess time requirement placed upon the students and offer incentive to complete the WB as fully as possible. By making the WB required content, an adequate sample size from which to draw statistically significant conclusions would be achieved. This would allow for a comparison of the forms of CR used by second, third and fourth year students. The study could be replicated using OT students at UBC and at other universities (adapting the content to ensure applicability to all sites). With an adequate sample size, the designs of the three WB could be statistically evaluated to determine what forms of CR were facilitated. The above information would be useful for program planning. This has implications regarding formats for course design -- e.g. self-study, in class or on-line used alone or some combination.

It would also be useful to repeat the study with the cases redesigned to fit more closely with the tenets of Cognitive Flexibility Theory (Jonassen et al., 1997; Spiro et al., 1987). This would include making explicit links within and between the cases regarding multiple themes and perspectives in order to enable students to recognize similar cases that require different actions based on a given change in context.

Looking more broadly, other uses of web-based case studies for clinical reasoning can be researched. It would be beneficial to know what forms of CR occupational therapy students versus expert occupational therapists use to complete WB when planning continuing education. How can web-based cases be used to promote
interdisciplinary team decision-making in actual practice? How should these cases be modified to reflect the forms of clinical reasoning used in different health professions?

**Implications for Teaching/Learning**

From a technological standpoint, in order for WB to be successful tools for teaching/learning, sufficient adequate financial support is required. Costs incurred are for ongoing technical support for the designer and the students, and for hardware and software requirements to make the programs used run smoothly and quickly (avoiding unduly long download times especially when multimedia features are incorporated into the WB). Time for WB development, content changes and maintenance of links to the WWW needs to be made available. With each page of content and each multimedia feature added, the time to create the WB increases dramatically as does the potential for technological problems. For these WB, students need computers with e-mail and internet access. Students using "old" computers need to ensure that they have Java capabilities. Administrative support is also necessary to ensure that these financial, technical, equipment, and workload needs are adequately met.

I propose that WB have a role in teaching/learning and possible evaluation of clinical reasoning. This research indicates that students do not need to be taught the labels of the various forms of clinical reasoning (identified in this study); the designs of the case studies are more important. Evidence of these forms were found in the participants explanations and justifications for their decision making without the students having "learned" the specific forms of clinical reasoning. Further, the results of the study suggest that these WB may allow students to engage in more forms of clinical reasoning than the other types of case studies described by Neistadt, Wight and Mulligan (1998) and Vanleit (1995). I hypothesize that the participants learned the concepts through OT theories, frames of reference, and models of practice. However, the breadth and depth of their clinical reasoning using the WB remains unclear -- see "Implications for Further Research".

To use the WB used for teaching/learning or evaluation would be a beneficial endeavour for instructors in OT to determine what forms of clinical reasoning students are using. Although some training of the second evaluator was required for this study, a
reasonable degree of agreement about the forms of clinical reasoning evident was achieved. The "training" may not be required for OT instructors that are familiar with these forms. This series of WB, when associated with a course on assessment in OT or on clinical reasoning (thus making the evaluation relevant for the student) would be a useful tool for evaluation. If this series of web-based case studies were to be used for teaching/learning, further opportunities to probe the students' explanations and justifications are required. Avenues for presenting these opportunities have been discussed earlier. WB could be part of collaborative learning between students by completing the cases in pairs/small groups, peer review/discussions of results and debates of issues as examples to improve clinical reasoning. These opportunities would provide a rich source of teaching/learning for the students and the instructor.
References


APPENDIX A

Excerpts: Total Knee Replacement Case Study

Timothy O'Brien, a 68 year old gentleman, underwent a right total knee replacement yesterday at Victoria General Hospital. He has osteoarthritis of 30 year's duration in his knees, hips, thoracic spine and shoulders that has increasingly interfered with function for 2 years. He was seen by a Home Care occupational therapist three months ago who helped Timothy adapt his home and ways of doing his ADL to his satisfaction. A referral has been made to occupational therapy for mobility/gait training. You use the Canadian Model of Occupational Performance to guide your service (CMOP).

You should do which of the following in response to the referral?

a) begin mobility/ gait training as per the referral.
b) assess transfers.
c) interview the patient to determine the appropriateness of occupational therapy involvement.
d) explain to the doctor that occupational therapists do not assess/provide treatment for gait training.

(a) begin mobility/ gait training as per the referral.

Why did you choose (a)?

Describe a brief scenario of a possible outcome of choice (a), and list likely sequelae for the patient, the occupational therapist, and the team.

Click here to compare your scenario and list with an example.
(This is only one example of several possible outcomes.)
OR
Return to the beginning to choose another option.
OR
Go to the end of the case study.

Example:

Scenario: The physiotherapist stops you in the hallway after hearing you give instructions about walking to Timothy. She suggests that only one service provide recommendations for gait training, and that physiotherapy is the appropriate one. You decide to provide no further occupational therapy involvement for this problem.

Sequelae of (a) begin mobility/ gait training as per the referral:
- for the patient:
Timothy gets confused about whose recommendations to follow.
He may get fatigued having both the occupational and physical therapists providing
intervention for mobility/gait training. Possibly unnecessary or inappropriate assessment and treatment is received.

- **for the occupational therapist:**
  Time is diverted from other patients and responsibilities.
  There may be a deterioration in the working relationship with the physiotherapist.
  There is a lack of understanding about using CMOP. Job performance should be re-evaluated and mentoring provided to improve practice.

- **for the team:**
  A poor understanding of the role or occupational therapy is fostered.
  Inappropriate referrals will continue.
  Other patients are not seen, discharges are delayed, or possibly extra use of resources are implemented to compensate.
  Team cohesion may deteriorate.

Return to the beginning to choose another option.
OR
Go to the end of the case study.

Did this case study help you reflect on how you made your clinical decisions? Please provide a detailed explanation.
APPENDIX B

Excerpts: Soft Tissue Injury Case Study

Referral Data
Stephanie Lawton is a 22 year old woman who sustained soft tissue injuries to her neck, right shoulder, and back when her car was rear-ended while stopped at a pedestrian crossing. X-rays indicated no fractures were present. Stephanie was sent home with Tylenol #3’s to take prn (up to 6 tablets per day). She was told to see her family practitioner, Dr. B. Well, the next day for follow up care. He told her to do her activities within her limits of pain and to keep off work for a couple of weeks.

It has now been 30 days post injury and Stephanie has not yet returned to work as a travel agent for Dream Holidays Inc. Her insurance company has made a referral to you as an occupational therapist for assessment and treatment as required. Their ultimate goal is to have Stephanie return to work full time. She is not represented by legal council.

Choose one of the following as your FIRST STEP in this case OR Choose Learning Issues

a) Contact the employer to discuss options for Stephanie's return to work.
b) Contact the physician for approval of referral for OT assessment and intervention.
c) Contact Stephanie to set up an initial interview.
d) Contact the hospital's Medical Records Department to gather relevant information.

Learning Issues: (optional link if questions to assist your decision making are desired)
From whom is a referral required? How does this change in various settings? (link with BCSOT home page)
Legally, what process must be followed to discuss a client with another person
What does your chosen model of OT practice suggest as the first step in initiating the OT process?
What do you need to know about the client to plan towards successful intervention?
What do you need to know about job?
What information regarding the boss might be useful?
How does the order of contact affect communication and cooperation?

Type the three highest priorities from the above issues. Give the reasons for your choice.
(You may add issues not yet mentioned that would help you to make the decision in this first step.)

Return to the FIRST STEP

c) Contact Stephanie to set up an initial interview.
Why did you choose this response?

Click here to see a likely result of this choice.

**Result:** Stephanie says her doctor told her he was referring her to physiotherapy but she hasn't heard anything about occupational therapy. She says that she had better speak with him first, and wants to know how you got her name, and will the insurance agency cut off her payments if she doesn't do what you say?

Return to the FIRST STEP

b) Contact the physician for approval of referral for OT assessment and intervention. Why did you choose this response?

Click here to see a likely result of this choice.

**Result:** You obtain consent for assessment and intervention of activities of daily living including return to work. (If the client was represented by legal council, approval to assess and treat that client would also have to be granted by the lawyer prior to client contact.)

Go to the SECOND STEP
Or
Return to the FIRST STEP

SECOND STEP:
You have obtained agreement for assessment and intervention as needed from the physician (and lawyer if one had been secured). There is nothing of note in the previous medical history. Next, you call Stephanie to get informed consent. You explain the role of occupational therapy and make an appointment to see her. Your initial meeting will primarily address which purpose?

Choose one of the following OR Choose Learning Issues
a) To explain to Stephanie occupational therapy program you will implement.

b) To support Stephanie by reassuring her that she will return to her old job.

c) To investigate the possibility that Stephanie is magnifying her symptoms.

d) To identify Stephanie's concerns and goals regarding her activities of daily living.

d) To identify Stephanie's concerns and goals regarding her activities of daily living.
Results: Stephanie explains the impact of her injuries and the accident on her life and identifies her goals for the future.

The following additional data is acquired using the Canadian Occupational Performance Measure (COPM):

Stephanie lives in an apartment with an elevator in North Vancouver with one roommate. She has no family in town but has a boyfriend of 2 years duration.

Since the accident Stephanie has been experiencing headaches daily. The headaches are precipitated by moving her head. As such, Stephanie has been wearing a soft collar when out of her apartment and she tries to turn with her body instead of her head. The Tylenol #3's are ineffective in eliminating the pain. She has not been using her left (dominant) hand and arm due to pain and she keeps it "guarded". Her physician is seeing her weekly to follow up on her progress. The physician has just referred her to physiotherapy for a program to improve strength and endurance.

Her roommate has been coping with all the household chores (cooking, cleaning, laundry, shopping) since the accident. These were shared responsibilities prior to the accident. Bathing, grooming, dressing, and self feeding are done independently but with pain. Stephanie is wearing loose clothing to facilitate dressing and does all activities one handed.

Stephanie was involved many sports (eg. swimming, badminton, and aerobic classes) in which she is no longer participating. She is no longer driving and is not going out with friends as she finds it painful to sit, and turning her head in conversation brings on a headache. She has not resumed sexual activities with her boyfriend as Stephanie cannot find a comfortable position. Stephanie wakes up nightly and has difficulty falling back asleep. She states she is getting approximately 4 hours of interrupted sleep per night. Her boyfriend is starting to get frustrated; he tells her that since nothing is broken, and a whole month for recuperation has passed, she should start getting back to her old routines.

Since the accident, Stephanie has not attempted to work in her old job at Dream Holidays Inc. Stephanie is looking forward to being involved in a rehabilitation program and to regaining her independence at home, at work, and socially.
THIRD STEP:
Stephanie identifies her top five occupational performance problems (OPPs) as: (in order of priority)
Unable to sleep through the night
Unable to resume social life, including sexual relations with her boyfriend
Unable to return to work duties
Unable to resume sports - e.g. swimming, badminton, and aerobic classes
Unable to drive

You decide that you need more in depth information before you and Stephanie can develop realistic and achievable goals and a treatment plan. What is (are) the next priority(priorities) to assess?

Choose from the following OR Choose Learning Issues
a) Range of motion (active and passive) and strength in the left shoulder, neck, and back especially.
b) Work station set up.
c) Perception of pain.
d) Instrumental activities of daily living (IADL).

Perception of pain.
Why did you choose this response?

Click here to see a likely result of this choice.

Results: A subjective rating of pain (and possibly location, quality, duration) at that time is obtained. In doing so, Stephanie's perceptions are acknowledged and can be used for future comparison. However, further information is still needed.

Return to the THIRD STEP

FOURTH STEP:
Identify (below) the specific assessment tools and methods you would use to complete your assessment for the THIRD STEP. You may add other assessments that you think are required. Explain your reasons for the specific assessment choices made.

Click here to compare your response with a sample.

Did this case study help you reflect on how you made your clinical decisions? Please provide a detailed explanation.
Maria is an eight year old girl who sustained a traumatic brain injury three months ago in a motor vehicle accident. She was flown to Vancouver for treatment following stabilization at her local hospital. A CT scan showed hemorrhage in the right mid brain, thalamus, and the left basal ganglia. She was non-verbal for five weeks. Maria has a residual right hemiparesis and a right third nerve palsy. She is returning to Whitehorse now to her family and to school. Maria has just been referred to you as an occupational therapist providing services to children in Whitehorse at home and at school.

You have screened the referral and determined that it is an appropriate one. You are planning your first meeting with Maria and her mother. You guide your therapy using the Canadian Model of Occupational Performance (CMOP) and a neurodevelopmental perspective. Which assessment is most appropriate as an initial step to gather information?

a) Play History (revised)
b) Canadian Occupational Performance Measure (COPM) 2nd Edition
c) Occupational Performance History Interview (OPHI)
d) Life Style Performance Profile Occupational History
e) Identify your choice if it has not been listed above

a) Play History (revised)
Give detailed reasons why you think this is the most appropriate choice.

Go on to view the information gathered.

or
View another choice offered.

From the initial interview (using the COPM) you learn that Maria wants to return to her previous interests which include hockey (in a league), jazz dance, skipping, jumpsies (involving jumping sequences over a large elastic loop), watching television, and playing imagination games. Maria is ambivalent about returning to school because "the right arm and leg don't work so well now" and she has "trouble remembering words" but she is looking forward to seeing her friends and teachers again. She says that she was in grade two with her highest marks being in Gym, Language Arts, and Science. Least enjoyed subjects were Math and Art. She was very popular at school prior the accident and her friends and schoolmates have kept in contact by sending Maria cards and letters while she was recovering in Vancouver. She was a competitive, self-motivated child.

Maria lives with her parents, Francis and Gino, and two little sisters (ages 3 and 5) in a one story bungalow. Gino owns a restaurant and works long hours there. Francis helps out in the restaurant a few evenings a week. Friends of the family look after the children.
when Francis is working. They have been very supportive over Maria's convalescence and taken care of the children so Francis could go to Vancouver to visit Maria periodically.

Maria used to be independent in dressing, toileting, bathing (with occasional supervision), and grooming, with reminders of when to take a bath and wash her hair. She had assistance from her mother to style her hair. Frequent reminders were needed for Maria to make her bed, put her clothes in the laundry basket, and to put her toys away. At present her mother reports that Maria receives help to get dressed; often Maria forgets about the right side when dressing. Help is also being given for bathing and toileting. Maria can (messily) feed herself left handed; she is trying to write left handed also. Maria says that learning to write again is very hard. Her mother reports of letter and number reversals, spacing, formation, and size errors. She used a computer while she was in Vancouver (as well as previously successfully in Whitehorse) but that was hard too. Incorrect spelling and excessive time finding the letters were noted. Francis reported that Maria has double vision which is eliminated when an eye patch is worn. You note that Maria has word finding problems during the interview. Her mother helped by providing the words if Maria started to get frustrated, which happened easily.

The occupational performance goals Maria would like to achieve are:

to play skipping games - importance: 9 satisfaction: 1 performance: 2
to play jumpsies - importance: 8 satisfaction: 2 performance: 2
to get dressed by herself; - importance: 8 satisfaction: 4 performance: 4
to be able to jazz dance - importance: 7 satisfaction: 3 performance: 3
to play on her hockey team - importance: 7 satisfaction: 1 performance: 1

Francis and Gino's goals for Maria are:
to write legibly - importance: 10 satisfaction: 2 performance: 2
to read at grade level - importance: 10 satisfaction: 1 performance: 2
to be independent in dressing - importance: 10 satisfaction: 2 performance: 3
to be independent in bathing - importance: 9 satisfaction: 2 performance: 3
to be independent in toileting - importance: 9 satisfaction: 3 performance: 6

Type in the three goals you would work on first. Give the reasons for your choices.

Go to the next screen.

To help you identify what is interfering with achievement of the identified goals you need to gather more information. Choose the most appropriate assessment for self care from the list below:

a) Wee FIM
b) informal observation
c) Barthel Index (revised)
d) Vulpe
e) Identify your choice if it has not been listed above

b) informal observation
Give detailed reasons why you think this is the most appropriate choice.

View another choice offered,
or
Go on to the view the information gathered.

Results based on the WeeFIM:

**Dressing** - assistance required to orient the clothing, reminders to put the right arm/leg in first and to remove the article of clothing fully off the right extremity. Assistance is needed to fasten buttons, zippers, and laces. All fastenings can be undone independently. Assistance applying the Ankle Foot Orthosis (AFO) on the right foot and a Benik long opponens splint on the right hand.

**Bathing** - supervision is required with transfers as Maria was impulsive, attempting to exit the tub before completing the task. Verbal cues were needed to wash the right side of her body. A clamp-on grab bar on the edge of the tub was used for balance/safety during transfers.

**Toileting** - independent using bars by the toilet except for dressing considerations mentioned above.

**Grooming** - independent to brush teeth and hair. Assistance to style hair is needed as per prior to the accident.

**Feeding** - uses utensils in left hand, uses a rocker knife in the left hand and a fork with a pronate palmar grasp in the right hand for cutting food. No difficulties with swallowing.

**Mobility** - ambulates independently wearing an AFO. Requires a railing for safety when using stairs. Impulsive at times which leads to falls - especially on uneven surfaces.

**Communication** - word finding difficulties noted; leads to frustration expressed verbally.

**Social Skills** - seeks cooperative play and imaginative play with adults, peers, and with siblings.

By observation you note that the flexor tone in the right hand, wrist, and elbow increases with effort (Brunnstrom level 4 ****link to definitions****) and that most tasks are accomplished left handed. There is a mild increase in flexor tone in the left wrist and elbow flexors. No splint is worn on the left hand. When the splint is worn, less cueing for right hand use is needed and a weak lateral pinch can be achieved; the thumb is adducted into the palm without splint use. The right lower extremity rests in adduction, internal rotation, and extension when the AFO is not worn. She bears most of her weight on the left side in sitting and standing with minimal crossing of the midline with her right upper extremity in activities.
Maria's attention to task during the assessment is approximately 20 minutes. She appeared motivated to complete the tasks as independently as possible.

You suspect that these observations will apply to Maria's identified leisure activity goals as well. By informal observation of Maria at play at home your suspicions are confirmed.

Proceed to the next screen.
OR
View another choice offered.

You have spoken with Maria's teacher who is pleased to do all she can to help Maria at school. She has asked for suggestions from you since she has noticed in letters from Maria that her spelling and language skills are far below what they were prior to the accident.

You now wish to gain information to help you find out why Maria is having difficulties with written communication to address potential difficulties completing her schoolwork. Choose the component(s) you wish to gain assessment data on:

a) visual perception
b) visual-motor integration
c) fine motor skills
d) visual acuity

For definitions of the above components click here.

State the reasons for the choice (a) you have selected.

Given the information you know so far, make an hypothesis as to which one of the above components is the basis of the difficulties in written communication.

Click here for one occupational therapist's hypothesis.
OR
Go to the next screen.
OR
View another choice offered.

Choose the most appropriate developmental assessment for Maria from the choices offered below.
a) Peabody Developmental Motor Scales
b) Vulpe
c) Early Intervention Developmental Profile  
d) Bruininks-Oseretsky Test of Motor Proficiency  
e) Identify your choice if it has not been listed above

d) Bruininks-Oseretsky Test of Motor Proficiency
Give detailed reasons why you think this is the most appropriate choice.

Go on to view the information gathered,
or
View another choice offered.

From the Bruininks-Oseretsky Test of Motor Proficiency you get the following information:

Running Speed and Agility 3 
  Balance 6 
  Bilateral Coordination 2 
  Strength 6 

Subtest Composite - Standard Score - Stanine
Gross Motor Composite: 17 - 20 - 1

Upper-Limb Coordination 1 
  Response Speed 13 
  Visual-Motor Control 1 
  Upper-Limb Speed and Dexterity 3 

Subtest Composite - Standard Score - Stanine
Fine Motor Composite: 17 - 23 - 1

Composite - Standard Score - Stanine
Battery Composite: 35 - 20 - 1

Maria scored poorly in any task involving anything other than preferred hand or foot use (now left). Visual-motor integration tasks were also very difficult for Maria.

Based on the data from this assessment, what conclusions can you draw? Type them below.
If there are other assessments you would administer before establishing your treatment plan list them below.

Did this case study help you reflect on how you made your clinical decisions? Please
provide a detailed explanation.

Feedback:
The Play History is a useful semi-structured interview with the primary care-giver to identify a child's play experience and play opportunities. The content is in accordance with the leisure (and possibly the productivity) aspects of the OPM and also is in accordance with a neurodevelopmental perspective. The population is appropriate for Maria and there is acceptable data for the total test scores reported for inter-rater reliability, test-retest reliability, and concurrent validity when using the Behnke and Fetkovich version. However, the information gathered is limited to play. In order to be more comprehensive in collecting information another interview would be needed.

Feedback:
OPHI: This semi-structured interview is based on the Model of Human Occupation but can be used eclectically. It addresses past and present patterns of function in occupational performance. There are no restrictions regarding population. Test-retest scores for the individual subscale are acceptable. Regarding validity it is reported that therapists found the interview helpful in establishing rapport, identifying patient problems and setting treatment goals.

Feedback:
The Bruininks-Oseretsky Test of Motor Proficiency is a standardized battery of fine and gross motor performance tasks. It was designed for a population ages 4.5 - 14.5 years. There are acceptable reliability and validity ratings but it is not valid for severely handicapped children. See the manual for population, normative groups, and psychometric data. There are long and short versions of this assessment.
APPENDIX D

On-line Semi-structured Interview Questions

After completing the three web-based case studies (WB), do you prefer this format or traditional paper-based cases (T)? Why?

Did you answer each question as fully as possible in the WB? Please explain. Would this be different if the research used T instead or WB? How?

There were 3 different designs for the WB cases (imagine a scenario and consequences; must choose a prescribed path to proceed; relative freedom of movement through the case). How did each type affect your clinical reasoning?

Which design did you prefer? Why?

The types feedback possible in each format - WB and T, differ (e.g. the timing/availability of feedback; non/specificity to your work).

How do the different types of feedback affect your clinical reasoning?

Which format do you prefer for feedback?

Did you ever discuss the cases with your classmates? If so, did you discuss content, your impressions (it was interesting/frustrating/boring), or both?

Did you do any searches on the Internet? If so, did you find information on the topic? Was it relevant/useful? Was it reliable? Valid?

Did you use any hot links to specified sites on the World Wide Web? If so, were they useful?

Do you want to change or add anything to the original question - do you prefer this format or traditional paper-based cases (T)? Why?

Do you have any questions for me?