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CRITICAL THINKING AND EVIDENCE-BASED PRACTICE IN PROBLEM-BASED LEARNING TUTORIAL GROUPS: A CRITICAL CASE STUDY

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DEDICATION

To my children Isaac and Marianne Hahn who bore witness and gave me the "Wow!" To my father and step-mother Matt and Lois Bortone, and my brother Matt Bortone whose pride in me warmed my heart. To my nieces Jessie, Allie, and especially Lissa Bortone who actually wants to read the finished product. To Kym Nixon who helped me realize my question had changed. To my dog Ziggy who accompanied me on long hikes in the woods which gave me perspective. To my dear friend Jess Weiner who rooted for me through the final "40%" and generously lent me his space to "cut and think." To my loving friends Jody Stockhammer, Barbara Driscoll, Ellen Holmon, Audrey Keegan, Julie Rosenberg, and Debbie Cuiffo who believed in me throughout this process and celebrated my success. To Rusty Herbert who inspired my imagination and cheered as I approached the finish line. To Cherise Hernandez and her son Neco who brought sunshine and rekindled my strength. To all my friends for their constant support, reminders to keep the focus on myself, and not get too distracted by the trials of life. To my faculty and colleagues who commiserated and celebrated with me. To Pat Walker, my Dean, who cleared the way and gave me her unwavering support. To Tony Cernera and Tom Forget, the president and academic vice president of the University, who directed me to Fordham and helped make pursuit of the doctorate possible.

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CHAPTER I

NATURE OF THE PROBLEM

Introduction

Shifting Demands in Health Care Education

Health care professionals today are faced with the demand to keep current with the best research evidence and best practices in caring for their patients (American Psychological Association Task Force on EBP, 2006; Holm, 2000; Law, 2002; Sackett, Straus, Richardson, Rosenberg, & Haynes, 2000; Solomon, 2005; Straus, Richardson, Glasziou, & Haynes, 2005). The explosion of biomedical research, technology and information accessibility combine to challenge practitioners to independently search out, determine the credibility of, and use new research evidence and practice advances as part of their clinical decision-making. Advances in practice and research must be integrated with the practitioner's own clinical experience, a solid theoretical foundation of knowledge from multiple disciplines, and a thorough evaluation of the patient's clinical circumstances, goals, values, and life contexts to make sound clinical decisions. In health care practice, this skill is called *clinical reasoning* or *clinical decision-making*.

The efficacy of occupational and physical therapy interventions are no longer ascertained by the functional outcomes of their patients (Holm, 2000; Scherer & Smith, 2002). Rather, practitioners are being asked "How do you know that what you

do and how you do it really works?" (Holm, 2000, p. 575). Practitioners must summarize the best available research on the intervention they wish to implement, describe that intervention, and outline how it should be implemented in order to yield optimal outcomes (Holm, 2000). Evidence-based practice (EBP) demands practitioners incorporate research evidence into their daily practice with the objective of improving care and outcomes for individual patients (Scherer & Smith, 2002; Straus, et al., 2005). Evidence-based practice has been a priority for occupational and physical therapists for the past several years, and health care education programs are challenged with having their students demonstrate the use of evidence in patient care decisions and in patient care (Holm, 2000; Scherer & Smith, 2002).

However, seeking and applying research evidence alone does not provide a complete picture of what skills students in health care education programs need in order to make clinical decisions. Embedded within evidence-based practice are the metacognitive skills of critical thinking and reflective practice. Once the evidence is found, students must evaluate the credibility and usefulness of both the sources of information, and the information and research itself, to the specific clinical case problem (Facione, 1990a; 1998; Straus et al., 2005). Students must apply critical thinking to all information they obtain including research, theoretical frames of reference, experience, the patient's goals, and patient evaluation information. They must also become "reflective practitioners" (Schön, 1983), identifying knowledge, skill strengths, and gaps and uncover their own reasoning processes, biases and emotions as they affect interactions, clinical decisions, and practice. Reflective

practice includes the development of strategies to self-correct gaps and errors (Facione, 1990a; 1998; Schön, 1983).

Thus, health care education programs must facilitate the development of a *system* of clinical reasoning in their students: Students must develop skills in critical thinking through evidence-based practice, develop interpersonal skills in collaborative teamwork and problem-solving, and learn and apply professional knowledge, skills and values to real-life practice (Baptist, 2003). Although traditional lecture-based approaches in health care education have long been considered optimal for teaching content knowledge, they are increasingly judged to be outmoded and inadequate to the challenge of teaching evidence-based practices, critical thinking, and clinical reasoning (Barrows, 1985; Doucet, Purdy, Kaufman, & Langille, 1998; Gillespie, 2002; Margetson, 1994; Straus et al. 2005). Given the unique demands placed on graduates as health care practitioners, the suitability of traditional educational approaches in health care education has been called into question. Health care educators are being held accountable for their graduates' preparedness for the world of real-life practice, and the acquisition of vast amounts of content knowledge is no longer deemed an adequate outcome (Barrows, 1985; Margetson, 1994). Instead, it is expected that learning will occur on a deeper level, that students will develop collaborative problem solving and metacognitive skills of reflection and critical thinking when making clinical decisions (Gillespie, 2002; Margetson, 1993; 1994; Sellheim, 2001).

Problem-Based Learning: A Method to Answer the Demand

Problem-based learning (PBL) approaches have been selected by more and more medical and health care education programs throughout the world as a solution to the "obsolescence of professional education" (Straus et al., 2005, p. 31) for its inherent requisite that students learn through a process of inquiry, evaluation, and reflection. "The success of learning by inquiry depends heavily on being able to find the current best evidence to manage pressing clinical problems" (Straus et al., 2005, p. 31). In other words, the success of PBL is dependent upon students' ability to engage in evidence-based practice, critical thinking, and clinical reasoning. The profusion of the use of PBL approaches in health care education curricula gives credence to the notion that PBL is considered by many to be a more viable approach to teaching critical thinking, evidence-based practices, and clinical reasoning (Albanese, 2000; Albanese & Mitchell, 1993; Bruhn, 1997; Butler, 19981999; Caterina & Stern, 2000; Solomon, 2005; VanLeit, Crowe, & Waterman, 2000). Although PBL is considered to be one of the most important educational developments in recent years, its efficacy in accomplishing these objectives is also widely debated Albanese, 2000; Colliver, 2000; Norman & Schmidt, 2000).

Significance of the Problem

Unprecedented Growth of Problem-Based Learning

Problem-based learning is extending beyond medicine and health care and into such fields as business and engineering, and expanding into undergraduate and secondary education. The fact that the PBL learning approach is on the increase is

remarkable given its greater cost and the fact that it has shown only mixed results in the empirical research regarding its efficacy (see for example, Albanese & Mitchell, 1993; Caterina & Stern, 2000; Colliver, 2000; Gijbels, Dochy, Van den Bossche, & Segers, 2005; Newman, 2003; Smits, Verbeek, & de Buisonjé, 2002; Vernon & Blake, 1993). Albanese (2000) posits that the tremendous expansion of PBL alone may be its most important outcome and is possibly indicative of efficacious outcomes that empirical research has yet to discover; something about PBL "works" or it would not continue to grow to the extent it has in health care education. He calls upon researchers to engage in both qualitative and quantitative study to uncover the theoretical underpinnings and outcomes of PBL and identify the "active ingredients" that make it such a compelling teaching method (Albanese, 2000).

Unanswered Research Questions

Although some studies and some findings exist on the effect that PBL has on students' critical thinking and clinical reasoning, virtually no research has been conducted on the most importantly identified outcome of PBL; evidence-based practices. Indeed, "little research has been conducted to date on how best we can teach the knowledge, attitudes, and skills of practicing and teaching EBM [EBP]" (Straus et al., 2005, p. 199). This is significant given health care education's emphasis on teaching evidence-based practices. Problem-based learning was specifically developed with the objective of facilitating students' evidence-based practice and has been explicitly and repeatedly chosen as an optimal teaching approach in health care education for this very reason.

None of the research examined or even fully described the instructional practices that were used in the PBL programs under study, so it remains unknown which instructional practices affected the outcomes and findings. Virtually no research was found attempting to identify the specific instructional practices that may or may not facilitate the student's ability to develop a system of clinical reasoning and develop skills in critical thinking and critical analysis through evidence-based practice. Does PBL accomplish these objectives and if it does, which instructional practices are successful at facilitating them? These fundamental questions have yet to be answered by the empirical research on PBL and make the study of the relationship between PBL instructional practices and evidence-based practices and critical thinking especially compelling.

Purpose of the Study

Little research exists investigating the relationship between the instructional practices used in PBL and its outcomes: It remains unknown whether or not PBL facilitates critical thinking or EBP. The empirical literature indicates that although students and tutors reported improved critical-thinking skills in PBL, these findings were obtained from students' and faculty perspectives rather than any quantitative measures of critical thinking (see for example, Birgegard & Lindquist, 1998; Pang et al., 2002; Stern, 1997). None of these studies provide detailed definitions of critical *thinking or describe the meaning improved critical thinking held for students and* tutors as a result of the PBL experience. Additionally, the exact nature of the facilitator's instructional practices that successfully facilitated students' critical thinking or EBP in PBL tutorial groups remains unknown. This study strives to

identify the relationship between the PBL facilitators' instructional practices and the influence these practices may have on students' development of a system of clinical reasoning using skills of critical thinking through evidence-based practices.

Research Questions

This research asks "What is the relationship between the facilitators' instructional practices and the development of a system of clinical reasoning using the skills of critical thinking and evidence-based practices?" "Do PBL instructional practices facilitate the development of critical thinking and EBP?" If they do, which ones? If they do not, are specific instructional practices needed to facilitate these skills?" Specifically, the researcher strives to ask:

1. How do PBL instructional practices need to be enhanced with specific strategies to guide critical thinking?
2. How do PBL instructional practices need to be enhanced with specific strategies to facilitate the use of evidence-based practices by students in PBL tutorials?

Theoretical Framework

This study is informed by the theory and research about PBL, evidence-based practice (Law, 2002; Sackett et al., 2000; Straus et al., 2005), and Facione's (1990a; 1998) cognitive learning theory of critical thinking. Building on the work on educational taxonomies in the cognitive and affective domains developed by Bloom (1956) and Krathwohl, Bloom, & Masia (1964), and the work of Dewey (1997) and Schön (1983) on reflective practice, Facione (1990a; 1998) developed a theory and

outline of instructional practices to facilitate critical thinking and reflective practice. Facione's (1990a) taxonomy is also consistent with Elstein, Shulman, and Sprafka's (1978) theory of and sequence of medical inquiry.

Theoretical Underpinnings of Clinical Reasoning

Norman (2000) observed in his review of the research and literature on clinical reasoning, that "it was definitely not skill-like," (p.1) that clinical reasoning is neither mastery, problem-solving, or experience, but all of these. He concluded that clinical reasoning has more to do with the practitioners' underlying mental processes as applied to knowledge and experience than with problem-solving strategies. Round (2001) concurred with this conclusion, noting that problem solving is content and context dependent whereas clinical reasoning is more internal to the practitioner's thinking.

Several researchers and authors, however, view clinical reasoning as a thinking process with an objective of solving clinical problems and making clinical decisions. Svidén and Hallin (1999) defined clinical reasoning as the "ability to distinguish and organize phenomena in order to make situationally appropriate decisions" (p. 63) and Neistadt (1996) emphasized that clinical reasoning was necessary in order for occupational therapists to establish priorities for treating their patients and adapt interventions to specific client situations.

Mattingly and Fleming (1994) define four types of reasoning as an organizational framework for clinical reasoning in occupational therapy: (a) interactive reasoning used to understand the patient's perspective; (b) procedural reasoning involving systematic data gathering, analysis, and problem solving; (c)

pragmatic reasoning involving practical considerations; and, (d) conditional or phenomenological reasoning involving both procedural and interactive strategies to understand the clinical situation and adapt and alter intervention approaches. Mattingly and Fleming's (1994) four types of reasoning for clinical reasoning is used extensively throughout the occupational therapy literature (see for example, Liu, Chan, & Hui-Chan, 2000; Neistadt, 1996; Svidén & Hallin,1999), but cannot be found in other literature on the subject (see for example, Norman, 2000; Round, 2001; Wood, 2000). However, they build their framework on the earlier work of Schön's (1983) reflective practice and Elstein et al.'s (1978) theory of medical inquiry, both found throughout the literature on clinical reasoning.

Elstein et al. (1978) define clinical reasoning as a process of "medical inquiry" and outline a four-step sequence to analyze clinical problems: The first, cue acquisition, is a process of gathering data that is usually unavailable and unknown at the start. The second step is hypothesis generation, where the practitioner develops hypotheses about the possible relationships between the various factors and cues in the case. The third step, cue interpretation, examines the specific cues or factors in the case and asks the question, "Will this cue make sense if the hypothesis is true?" The final step is called "hypothesis evaluation," whereby the hypotheses are evaluated for their plausibility. Elstein et al.'s (1978) sequence is similar in definition and to the processes included in Facione's (1990a) critical thinking as well as with Barrows's (1985) and Barrows and Tamblyn's (1980) phases of case analysis in PBL tutorial groups.

Theoretical Underpinnings of Critical Thinking

The literature postulates that the construct of critical thinking likely dates back 2500 years to the teachings of Socrates, Plato, and Aristotle, who encouraged students to engage in critical dialogue and explore knowledge beyond the obvious understanding (Burback, Matkin, & Fritz, 2004; Kamin, O'Sullivan, Younger, & Deterding, 2001). Critical thinking in its modern construct was articulated by Dewey (1997) as a process of "reflective thought." He believed that ideas, beliefs, and theory should be held up to inquiry and examination. In 1910 Dewey (1997) laid out a five-stage model of reflective thinking that enables one to engage in the "scrutiny and revision of evidence, of working out the implications of various hypotheses, and of comparing these theoretical results with one another and with known facts" (pp. 5–6). The model consists of five steps: (a) suggestions; (b) problem definition' (c) hypothesis generation; (d) reasoning; and (e) hypothesis testing. Dewey's (1997) model serves as the basis for later theorists and its stages include the foundational concepts found in Barrows's (1985) PBL model, Facione's (1990a; 1998) model of critical thinking, and Elstein et al.'s (1978) model of medical inquiry.

The 1980s marked a period during which interest in critical thinking was heightened among educators in various disciplines: Notably, Brookfield (1995) further developed Dewey's model of critical thinking, Watson and Glaser developed the widely used *Watson-Glaser Critical Thinking Appraisal* (1980) and Facione's *Delphi Report* (1990a) resulted in a consensus definition and taxonomy of critical-thinking skills, subskills, and instructional practices for teaching critical-thinking skills. The *Delphi Report* (Facione, 1990a) served as the basis for the development of

another widely used instrument to measure critical thinking skills, *The California Critical Thinking Skills Test (CCTST)* (Facione, 1990b). In addition to the definition and taxonomy of critical thinking, Facione (1990a) and his group identified several dispositional attitudes necessary for critical thinking and for teaching critical thinking:

> CT [critical thinking] is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life. While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. Thus, educating good critical thinkers means working toward this ideal. (p. 2)

Facione (1990a) and his group created a taxonomy of critical-thinking skills and subskills. This taxonomy serves as the basis for guiding faculty in instructing students how to think critically. Faculty adopts a line of questioning and modeling that facilitates each step along the taxonomy.

1. Interpretation—Categorize; decode the significance of concepts and information; clarify meaning of concepts and information.
2. Analysis—Examine ideas, identify and analyze arguments.
3. Evaluation—Assess the credibility of claims, arguments, and sources of information; judge the reasoning processes and evidence used to support conclusions or arguments.

4. Inference—Form conjectures, hypotheses, draw conclusions and inferences based on data, evidence, opinions, prior knowledge, and principles using sound reasoning.
5. Explanation—State results, justify procedures and present arguments. Use evidence and theory in soundly reasoned arguments to explain one's rational for decisions, conclusions, and hypotheses.
6. Self-Regulation—Self-reflection and examination to discover knowledge and skill strengths and gaps and uncover reasoning processes, biases, and emotions that *may affect interactions, clinical decisions, and practice. Self-regulation includes* developing strategies to correct these gaps and errors.

Reflective Practice and Facione's Self-Regulation

Schön (1983) developed his theory of reflective practice out of his analysis of the shortcomings of "technological rationality," the dominant epistemology of practice in the professions through World War II. Technological rationality in the professions consisted of "instrumental problem solving made rigorous by the application of scientific theory and technique. Only the professions practiced technological problem solving based on specialized scientific knowledge" (Schön, 1983, pp. 21–22). Schön's (1983) critique was brought about by two observations: (a) a crisis of confidence internal and external to the professions; and, (b) the perception that the professions had deprofessionalized themselves by unionization and the consequential implication that they were merely bureaucratic workers and not managers of their own careers. Following several high-profile failures of professionally managed projects (e.g., the Manhattan Project, the Vietnam War, the

loss of the space race to the Russians' successful launch of Sputnik, and the nuclear accident at Three Mile Island), the effectiveness and competency of the professions was severely criticized. The professions were perceived by the world and themselves as not reliable or competent to "solve social problems, to keep from creating new problems, and to meet reasonable standards of competence in their service to their clients" (Schön, 1983, pp. 12–13).

Schön (1983) postulated that the exclusive reliance on technological rationality with its emphasis on solving problems, completely omitted the context, the setting, and the process by which professionals define the decisions they make that contributed to the crisis in the professions. He saw the professions' responsibility as more than mere technological problem solving:

> In real-world practice, problems do not present themselves to the practitioner as givens. They must be constructed from the materials of problematic situations which are puzzling, troubling, and uncertain. In order to convert a problematic situation to a problem, a practitioner must do a certain kind of work. He must make sense of an uncertain situation that initially makes no sense. Even when a problem has been constructed, it may escape the categories of applied science because it presents itself as unique or unstable. (Schön, 1983, pp. 40–41)

The kind of inquiry requisite to construct problems, explore uncertainty, and resolve conflicting information falls outside the realm of technological epistemology and into what Schön (1983) calls "reflection-in-action" or reflective practice.

> Usually reflection on knowing-in-action goes together with reflection on the stuff at hand. There is some puzzling, or troubling, or interesting phenomenon with which the individual is trying to deal. As he tries to make sense of it, he also reflects on the understandings which have been implicit in his action, understandings which he surfaces, criticizes, restructures, and embodies in further action. (Schön, 1983, p. 50)

Schön (1983) noted that many in the professions do not view reflective practice as a rigorous or worthy of pursuit because it is not "scientific." He pointed to

the perception of many practitioners that reflective practice is a sign of weakness because it acknowledges the professional's own uncertainty and *not* knowing. These professionals he contends are too reliant on "selective inattention, junk categories, and situational control, techniques which they use to preserve the constancy of their knowledge" (p. 69). He links reflective practice to a rigorous process of inquiry and research. It is the very act of questioning what one does not know that motivates the professional to seek and to learn rather than rely exclusively on the knowledge that one already has.

Theoretical Underpinnings of Evidence-Based Practice

The experts on evidence-based practice tell us to "burn our traditional textbooks" (Straus et al., 2005, p. 32) because they are not appropriately organized for clinical use and much of the information they contain is outdated by the time of their printing. In addition, textbooks are useful only in so far as they can provide needed theoretical background information, but are not useful in guiding practitioners to answer clinical questions about "diagnosis, prognosis, therapy, and prevention" (Straus et al., 2005, p. 2). Health-care education students must be adept at seeking and learning new information, and at seeking, evaluating, and applying the best available research in preparation for practice. The specific strategies for developing skills in EBP, developed by Sackett et al. (2000) and Straus et al. (2005) in their decisive work on teaching evidence-based practice have become the model for teaching EBP in health care education. Critical thinking is essential to the successful implementation of EBP because critical thinking is required in order too engage in the inquiry process, evaluate the credibility of sources of information, evaluate the

plausibility of the hypotheses, evaluate the utility of research evidence and one's own reasoning.

Dornan, Scherpbier, King, and Boshuizen (2005), Niestadt (1998), and Round (2001) strongly advocate the use of specific instructional strategies as necessary to teach clinical reasoning. Round (1999) lamented that "explicit teaching on good clinical reasoning and decision-making is rarely a part of a medical school curriculum" (p. 483) and that there is a need to teach these skills formally in health care education programs (Round, 2001). Neistadt (1998) states that occupational therapy students need explicit instruction in clinical reasoning because "students cannot be expected to infer thinking frames from modeling alone" and that "without explicit definitions of clinical reasoning, students will not understand the various types of thinking used in clinical practice from instructors' modeling of the clinical thinking process" (p. 222). Similarly, Straus et al. (2005) and Facione (1990a) contend that specific instructional strategies are needed to teach students EBP and critical thinking.

Definition of Terms

Instructional Activities

Instructional practices are those that 'identify a specific method of teaching and learning.' Instructional practices are guided by vastly different philosophical underpinnings that determine student and faculty roles and responsibilities.

Problem-Based Learning

> What distinguished PBL from other problem-centered methods, such as the case method, is that in PBL the problem is presented first before students have learned basic science or clinical concepts, not after . . . thus they provide greater realism and free inquiry. (Albanese & Mitchell, 1993, p. 53)

The essential characteristic of problem-based learning is that students learn content knowledge in a clinical case context (Moore, Block, Style, & Mitchell, 1994). Students work in small group *tutorials* consisting of five to seven students guided by a *tutor* or *facilitator* who may be a faculty member or clinical expert. Students discuss the case, identify the background information they need to enhance their understanding, formulate hypotheses regarding how one factor of the case may relate to another factor, and ask clinical questions that need to be answered. In so doing, students identify the learning issues—the topics they need to learn more about and the depth and breadth in which they need to learn it. Students, independently and in a self-directed manner, inquire into the needed information, develop hypotheses, and seek to answer the clinical questions. They then bring this information back to the tutorial group for discussion and collaboratively test the hypotheses, challenge the credibility of the sources of information and the information, and see if they have enough information to answer the clinical questions of the case. Emphasis is on understanding the meaning of concepts rather than on defining them (Vernon & Blake, 1993).

The *tutor* serves as a "cognitive and metacognitive" guide and facilitator of students' critical thinking and generally does not serve as an expert imparting information and answering students' questions (Baptiste, 2003). Tutors must possess clinical knowledge and skills, be adept at facilitating critical thinking and managing

group process. Tutorial groups are marked by a high degree of student interaction, discussions, and participation. In PBL, faculty regards students as colleagues who are novices.

The underlying philosophical values guiding PBL instructional practices are best expressed by Maudsley (1999):

> First, knowledge is acquired in an active, iterative, and self-directed way, predominantly by working on a progressive framework of problems unconstrained by subject divisions. Second, acquiring new subject knowledge is not the starting point for learning. Third, process details may vary but only *within* this philosophy, which should not be undermined by other curricular elements (p. 180).

The Tutor. The PBL tutors in this study are adjunct faculty members who are clinical practitioners with expertise in the content area of the PBL course. The PBL tutor is responsible for facilitating the PBL tutorial group and process and for evaluating students in PBL tutorials. The tutor's evaluation of students' performance in tutorial groups contributes to a significant percentage of the students' final course grade. The tutor is directly supervised by the course instructor. The role of the tutor is to facilitate and guide students in their thinking about the case rather than directly teach content. The tutor is also responsible for monitoring and assisting the group with its process. The PBL tutorial process consists of several phases of work, beginning "reporting out" or discussing the issues identified in the previous tutorial session, opening the new case and identifying its relevant learning issues, and peer and self-evaluation. Although each tutorial group is responsible for establishing its own way of working or format, the tutor is responsible for assuring that the tutorial group completes all the phases of the tutorial process.

The term *tutor* and *facilitator* are used interchangeably in both the literature and in this dissertation document. However, the term *facilitation* is also used as a verb to describe the practice of guiding the PBL tutorial process and assisting the group in its thinking about the case. Some PBL tutorial groups assigned a *student facilitator* meaning that a student was expected to assume some aspects of the facilitatory role function usually assumed by the tutor during that tutorial session. Student facilitators are expected to challenge the group to think critically about the case and information and to pose critically challenging questions to their peers in tutorial. In this document, the term *facilitator* refers only to the adjunct faculty tutor and the term *student facilitator* is used to describe the instances when students assumed that role.

Group Format. Each PBL tutorial group is responsible for establishing its own way of working through each phase of the PBL process. In this study, differences in group format were most marked during the *reporting out* phase. During this phase, the tutorial group must communicate, analyze, and synthesize all the information each student obtained on the learning issue they were to research since the previous tutorial. Tutorial groups primarily followed two strategies; each student reporting his or her information to the group round-robin style, or, general group discussion where students shared and discussed the information they had out of turn as it related to a specific topic or learning issue in the case. These two formats are referred to *round-robin* and *discussion format* in this document.

Traditional Learning Methods

Problem-based learning methods may be ambiguous and difficult to define, but so too are traditional methods. *Traditional learning methods* are 'largely marked by teacher-directed learning activities, assignments, and objectives.' The lecture, while not the only activity used in traditional curricula, remains the predominant learning activity in higher education (Margetson, 1994). Cases, laboratories, and experiential exercises are often augmented learning activities and are generally designed to illustrate concepts already taught (Albanese & Mitchell, 1993).

In health-care education, the traditional "curriculum tends to be characterized by a one-to-two-year basic science segment composed of formal courses drawn from various basic science disciplines" (Albanese & Mitchell, 1993, p. 54). The *subject discipline* is the impetus for learning and each subject is learned in isolation from other subjects (Margetson, 1994). The desired outcomes are reiteration, comprehension, and application of concepts, generally as demonstrated through passing multiple choice tests. Cases are often presented in an already synthesized manner and are used to illustrate concepts that have been determined by the course instructor, or, they may serve as a model or exercise to apply concepts (Gillette & Stern, 1998; Margetson, 1994).

The underlying philosophical assumption guiding traditional methods is the belief that knowledge must come first, followed by application (Margetson, 2000). Students first acquire knowledge and theory in the security of a more controlled educational setting, so that they will be able to apply it later in the more unpredictable practice situation. Faculty are viewed as the experts on subject knowledge and are

expected to impart their knowledge to receptive students. In traditional curricula, students are dependent upon faculty for their learning and for direction as to what to learn. Students in lectures are by and large passive learners, with minimal opportunity for interaction, dialogue, critical analysis, or collaboration. The lecture "remains essentially a performance by the lecturer: students sit largely passively and hear of critical, imaginative work. They seldom actively engage in it" (Margetson, 1994, p. 11).

Clinical Reasoning

Clinical reasoning is used interchangeably throughout the literature with the terms *clinical problem solving* and *clinical decision-making* (Round, 2001). It is extremely difficult to discern a consistent or even majority opinion in the literature as to the definition of *clinical reasoning*. Many writers define *clinical reasoning* as "a thinking process unrelated to problem solving or decision-making" (Norman, 2000; Round, 2001). Others view clinical reasoning as a thinking process that enables the practitioner to make clinically appropriate decisions in the practice context (Baptist, 2003; Barrows & Tamblyn, 1980; Neistadt, 1996; Svidén and Hallin, 1999). Clinical reasoning is difficult to concisely define in a manner that "captures the subtlety of how therapists think in the midst of practice" (Mattingly & Fleming, 1994, p. 9).

In the context of this research, the definitions of clinical reasoning outlined by Barrows and Tamblyn (1980) and Baptist (2003) will be used for their consistency with PBL instructional practices and philosophy. Barrows and Tamblyn (1980) identified clinical reasoning as the most vital set of abilities that practitioners must possess and the overarching goal for PBL. They chose the term *clinical reasoning*

"to encompass all the cognitive skills implied in the patient evaluation and management" (Barrows & Tamblyn, 1980, p. 20), including inquiry and data gathering, evaluation of data, clinical judgment, problem solving, and decision-making. Baptise (2003) states that occupational therapists must develop a *system* of clinical reasoning which includes critical thinking through EBP. This definition encompasses multiple sets of cognitive and metacognitive skills including critical thinking and EBP.

Neistadt (1998) and Round (2001) strongly advocate that instructional practices must include specific strategies in order to successfully teach clinical reasoning. Although clinical reasoning itself cannot be directly observed as a thinking process, its behavioral manifestations can be. Engagement in critical thinking, evidence-based practices, and the types of reasoning a practitioner may use can be observed and or gleaned from interviews and inquiry.

Critical Thinking

Critical thinking is considered essential to higher education curricula because it is believed to promote "cognitive accountability" (Fowler, n.d.). Through the process of critical thinking, students develop and use reliable criteria to evaluate the credibility of research, theoretical information, and the sources of that information. Engaging in critical thinking allows students to develop an increased awareness of factors from multiple contexts. Engaging in critical thinking can bring about a paradigm shift in students' learning from teacher-directed activities to independent, self-directed learning and thinking—an essential PBL instructional practice (Barrows, 1998; Birgegard & Lindquist, 1998; Dornan et al., 2005; Facione, 1990a; Pang et al.,

2002; VanLeit, 1995). Kamin et al. (2001) claim that critical thinking does not necessarily result with clinical decisions, but in a greater understanding of the problem. Unlike clinical reasoning, critical thinking is not restricted to health-care education but is a universal construct and educational objective in higher education.

Like Baptist (2003), Kamin et al. (2001) view critical thinking as a cognitive process interrelated with EBP: critical thinking involves the "analysis of premises, arguments, and evidence" (p. 28). Kamin et al. (2001) view PBL as an optimal method for students learning critical thinking because in PBL, "ideas are held open to scrutiny by the group, encouraging inquiry-based attitudes that depend on recognizing problems and logically assessing evidence. These skills reflect the construct of critical thinking" (p. 27).

Facione (1990a), under the direction of the American Philosophical Association, led an investigative study of critical thinking. He put together a panel of 46 experts on critical thinking including researchers and educators in philosophy, education, social, and physical sciences. The investigators used the Delphi qualitative research method, resulting in a consensus definition of critical thinking, taxonomies of core critical thinking skills and subskills, and recommendations for teaching critical thinking skills. Facione (1990a) used the core critical-thinking skills identified in *The Delphi Report* to develop an instrument to measure critical thinking skills, *The California Critical Thinking Skills Test (CCTST)* (Facione, 1990b). The rigorous research with which Facione's (1990a) critical-thinking framework was developed led this researcher to select Facione's construct and the *CCTST* as a

measure of critical thinking in this study. Facione's (1990a) definition of critical thinking is as follows:

> We understand critical thinking to be a purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation and inference as well as explanation of the evidential conceptual methodological, criteriological, or contextual considerations upon which that judgment was based. (p. 2)

Schön's (1983) theory of reflective practice is incorporated fully in Facione's (1990a) final step of "self-regulation" in his taxonomy of critical thinking skills.

> In critical thinking a person gives reasoned consideration to evidence, context, theories, methods and criteria in order to form this purposeful judgment. Critical thinking [CT] is not a linear or step-by-step process. CT's reflexivity permits one to use CT in judging the reasonableness of the very theories being relied upon, the evidence being presented, the criteria or standards of judgment being appealed to, the relevance of the contextual elements being described, or the validity of the methods of inquiry being used. (Facione, Facione, Blohm, & Giancarlo, 2002, p. 3)

Reflective Practice

Reflective practice was originally conceptualized by Schön (1983) and built upon by Facione (1990a) into the self-regulation process that allows for the practitioner's learning and self-correction. Schön (1983) viewed the professional's responsibility as extending beyond technological problem solving to the kind of inquiry requisite to construct problems, explore uncertainty, and resolve conflicting information. To do this, the practitioner must engage in *reflective practice*, a kind of 'self-questioning' whereby practitioners may ask themselves,

> "What features do I notice when I recognize this thing? What are the criteria by which I make this judgment? What procedures am I enacting when I perform this skill? How am I framing the problem that I am trying to solve?" (Schön, 1983, p. 50).

This kind of questioning lies at the heart of reflective practice. It is through self-evaluation of what one knows and does not know, how one thinks about a clinical case, what thoughts, emotions, beliefs went into one's judgments about the clinical picture, that professionals can identify the knowledge and skills needed, what attitudes and perceptions need correction, and what information to seek.

Evidence-Based Practice

Virtually all health care education programs are required by their accrediting bodies to teach students evidence-based practice skills. Evidence-based practice (EBP) is one of the primary objectives of PBL; it is a skill Barrows (1985) observed in expert practitioners that his students did not use. The goal of facilitating students to become adept at evidence-based practices provoked Barrows (1985) to develop the PBL method. The experts on EBP, Sackett et al. (2000) and Straus et al. (2005) concur that PBL may be the most effective way to teach EBP in health-care education programs because it is based on processes of inquiry and evaluation.

Evidence-based practice, also called evidence-based medicine, is defined as "the integration of the best research evidence with our clinical expertise and our patient's unique values and circumstances" (Straus et al., 2005, p. 1). Evidence-based practice involves consideration of three distinct dimensions: (a) the best research evidence available; (b) the practitioners own clinical experience and expertise; and, (c) a thorough evaluation of the patients' clinical situation, life contexts, personal perspectives, and goals for their own care. Evidence-based practice 'is a process based on a systematic series of inquiry, evaluation, and reflection.' It incorporates critical thinking processes and all types of clinical reasoning processes. Evidence-

based practice can be differentiated from critical-thinking and clinical-reasoning processes by its focus on inquiry into, and analysis and application of research evidence.

Students in preparation for a life-long career in health care practice must become adept at seeking and learning new information, and at seeking, evaluating, and applying the best available research. For this reason, specific strategies for developing skills in EBP were developed first by Sackett et al. (2000) and later refined by Straus et al. (2005) in their seminal work on teaching evidence-based practice. Embedded within EBP is the process of critical thinking. Critical thinking is essential to the successful implementation of EBP. Critical thinking is the act of evaluating the credibility of sources of and of information, identifying what information and learning is needed to solve the clinical problem, engaging in a process of inquiry to obtain the information and evaluating the information and one's own reasoning processes used to make decisions.

Although Barrows (1985) and Barrows and Tamblyn (1980) held EBP and clinical reasoning as their visionary goal and rationale for developing PBL, the PBL instructional practices outlined in the PBL model do not include specific instructional practices identified by experts on critical thinking and EBP that could successfully teach those skills. Prior to conducting this study, this researcher has observed that PBL instructional practices do not necessarily facilitate students' critical thinking or EBP. These two factors have led to this researcher's contention that specific critical thinking and EBP instructional practices must be incorporated into PBL in order to teach these skills. Straus et al. (2005) provide the definition and outline the

instructional practices to teach EBP. The *Self-Evaluation in Evidence-based Practice* and the *Self-Evaluation in Teaching Evidence-Based Practice* developed by Sackett et al. (2000) and refined by Straus et al. (2005) was adapted with a Likert scale and used as a self-assessment of EBP for students and facilitators in this study.

Curricular Design

A program's curriculum design reflects its own mission and philosophy of learning. The occupational and physical therapy programs in this study share a philosophy of learning obtained from problem-based learning. Additionally, each program reflects the philosophical assumptions shared by the professions of occupational and physical therapy respectively. Curricular design 'includes the objectives of the program and how its content is organized and in what sequence.' Hence, curriculum design shapes the content and expectations of each and every course in the program. Course syllabi include the specific expectations for the level of content knowledge, skills, and attitudes as outlined in the curriculum sequence. Both the occupational and physical therapy programs dictate a lock-step curriculum, with clearly defined course work that must be taken in a prescribed sequence. The PBL course syllabi used in this study adhere to specific expectations for acquisition and level of content knowledge, skill, and use of evidence-based practices as defined by each program's curriculum design.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

Overview

This investigation attempted to identify the instructional practices of PBL tutors that did or did not facilitate the development of a system of clinical reasoning through critical thinking skills and evidence-based practice that can be applied in practice. The specific instructional practices that are successful in facilitating the goals of PBL are what Albanese (2000) calls the "active ingredients" of PBL. Although a substantial body of research exists investigating the outcomes of PBL programs, much of this research uses outcome measures that are not the stated outcomes of PBL. Additionally, little research exists investigating the relationship between the instructional practices used in PBL and its outcomes, although several studies infer the importance of that relationship (see for example, Birgegard & Lindquist, 1998; Dolmans & Wolfhagen, 2005; Pang et al., 2002; Silén, 2006; Stern & D'Amico, 2001).

Review of the Theoretical Literature

History and Background of Problem-Based Learning

Howard S. Barrows at the McMaster University School of Medicine in Canada developed the PBL approach during the mid 1960s (Barrows, 1985; Barrows &

Tamblyn, 1980) out of the desire to facilitate a deeper level of learning that students could apply in real clinical situations as an alternative to traditional, lecture-based educational curricula that focused on the acquisition and memorization of content knowledge. Barrows and Tamblyn (1980) and Barrows (1985) observed that despite passing content knowledge tests, medical students from traditional lecture-based educational programs tended not to seek out new information or empirical research relevant to their patients' cases and were not able to recall or appropriately apply previously memorized information to the diagnosis and treatment of patients in clinical settings. In contrast, Barrows (1985) observed that expert practitioners used knowledge from a variety of disciplines, evaluated the relevancy of the empirical research to their particular cases, integrated it with their own clinical experience and a thorough evaluation of the patient's situation, and then collaborated with their team in making clinical decisions. Barrows and Tamblyn (1980) sought to create an educational approach that mirrored clinical practice and taught students the skills relevant to that practice, consequently developing PBL. The learning objectives and essential characteristics Barrows and Tamblyn (1980) and later Barrows (1985; 1986; 1994; 1998; 2000) outlined were unique to PBL and distinguished it from the objectives and methods used in traditional educational approaches predominant in health care education curricula.

The Evolution of Barrows's Problem-Based Learning Model

Barrows (1986) sought to differentiate his PBL model from the wide variety of PBL curricula espoused in the instructional and empirical literature, noting that PBL curricula did in fact use a variety of PBL methods and objectives and appeared

to be engaged in different educational endeavors. It was Barrows's perception (1986; 1998) that these curricula shared a single common element; namely, that they used problems as the impetus for learning. This perception was verified by later survey research conducted on PBL curricula in U.S. medical schools. When compared to Barrows's PBL model as a standard, the range of PBL practices in these curricula was wide; sharing only the single element that a patient problem was used to initiate learning (Kelson & Distlehorst, 2000; Maudsley, 1999).

Barrows (1986) believed that curricular design and the specific PBL instructional practices mattered a great deal when assessing PBL outcomes. Hence he sought to clearly articulate and refine his PBL model in six of his publications. The first, *Problem-Based Learning: An Approach to Medical Education* (Barrows & Tamblyn, 1980) outlined the PBL model. Barrows and Tamblyn (1980) is the building block of a large number of PBL curricula as it is the single most-referenced publication in PBL research and instructional literature.

Barrows (1985) continued to make changes to and refine his model of PBL in five subsequent publications: *How to Design a Problem-Based Curriculum for the Preclinical Years*, outlined the goals and objectives of the PBL model and discussed specific instructional methods to facilitate these goals. Barrows (1986) then wrote an article "A Taxonomy of Problem-Based Learning Methods" that divided the PBL model into two distinct dimensions with the intent of providing educators and researchers with a more logical structure that could be used to design PBL curricula and conduct research. The two dimensions include a taxonomy of educational objectives outlining what students should learn, and the instructional practices or

methods outlining how learning should occur in PBL. Barrows (1986) believed that curricula should be aligned with PBL objectives they aspire to achieve and then further aligned with appropriate PBL instructional methods. The degree to which the methods are used determine the degree to which PBL outcomes can be achieved (Barrows, 1986). *Practice-Based Learning: Problem-Based Learning Applied to Medical Education* (Barrows, 1994) further articulated the model and methods in an attempt to distinguish them from the many varieties of PBL found in the instructional and empirical literature at that time.

In 1998, Barrows wrote *The Essentials of Problem-Based Learning* with the intention of defining "authentic PBL as a specific instructional method that addresses all the educational objectives possible with PBL" (p. 630). He eliminated the taxonomy he outlined earlier, explaining that it was no longer adequate to the task of developing PBL curricula, implementing PBL instructional practices or conducting research. By defining "authentic PBL" Barrows's aim was to provide a more coherent language with which the professional, research, and educational communities could communicate about PBL. To support his contention that a clear definition of "authentic PBL" was necessary, he cited the difficulties Vernon and Blake (1993) and Albanese and Mitchell (1993) discussed regarding the challenges they faced in their meta-analyses due to the complete absence of descriptions of each PBL program's content and instructional practices (Barrows, 1998). Authentic PBL consolidated the objectives for PBL and identified the characteristics and instructional practices critical to accomplishing the goals of PBL (Barrows, 1998).

In 2000, Barrows returned to the idea that PBL must be more clearly defined for the purpose of curriculum development, research, and professional dialogue. His newest publication, *Problem-Based Learning Applied to Medical Education* (Barrows, 2000) further developed a conceptual framework to analyze PBL programs.

Barrows's Model of Problem-Based Learning

Barrows (1986; 1985; 1998; 2000) distinguished the objectives in his PBL model as unique to PBL and not typically found in traditional curricula. The PBL objectives remain consistent throughout Barrows's many publications, although he organizes them differently in each; in some publications listing as few as three objectives and in others as many as seven. Substantial agreement and consistency with Barrows's objectives is found in the PBL instructional literature (Baptiste, 2003; Bruhn, 1997; Butler, 19981999; Caterina & Stern, 2000; Gillette & Stern, 1998; Hmelo-Silver, 2004; Maudsley, 1999; Neville, 1999; Walton & Mathews, 1989).

Goals and Objectives for Problem-Based Learning

The PBL objectives were originally outlined by Barrows (1985; 1986; 1994; 1998) and Barrows and Tamblyn (1980). The objectives that are addressed in "authentic PBL" are:

1. Develop an extensive knowledge base drawn from multiple disciplines, retained in long-term memory, recalled in the clinical context, and enmeshed in clinical reasoning used in practice.
2. Develop clinical reasoning skills as a way to understand and manage patient problems. This includes metacognitive skills of reflective practice, critical thinking, and evidence-based practices.
3. Develop independent, self-directed learning skills including methods, resources of inquiry, critical analysis, and synthesis.
4. Develop clinical skills in assessment, evaluation, intervention, communication, and interpersonal skills.

5. Develop a continual internal motivation to learn, question and understand.
6. Immersion into the culture and values of the profession.
7. Develop team collaboration skills. (Barrows, 2000, pp. 78–80)

Instructional Practices Essential to PBL

Barrows (1998; 2000) considered specific instructional practices requisite to "authentic PBL." In authentic PBL, "problems presented to students are those they will encounter in their professional activities and thus allow students to reason as they will have to do in practice" (Barrows, 1998, p. 632). The presence of the following instructional practices discerns "authentic PBL" from other varieties of PBL (Barrows, 2000):

1. Learning must be student-centered. Students are responsible for their own learning and, therefore, must have the power and authority to determine what their learning needs are, what methods of inquiry are best suited to learning, and what resources are needed to learn.
2. PBL case problems must be real patient problems and be presented in a format to allow students to engage in clinical reasoning as they would in practice. The case problems must elicit students' clinical reasoning abilities including the generation of multiple hypotheses, inquiry through knowledge, patient evaluation, analysis of data, and synthesis of information into a meaningful understanding of the patient's clinical situation. Students must then practice making clinical decisions in PBL. Inherent in these processes are critical thinking and evidence-based practice skills requiring students to seek out the best current research and information, evaluate it, and determine the credibility of the resources and information based on articulated criteria.

3. Cases must also include not only problems related to the patient's condition, but problems that the practitioner is likely to encounter in practice including patient and family education, issues regarding reimbursement and health care delivery contexts, community health issues, etc.
4. The tutorial process must require self-directed learning where students independently search for information from a variety of resources including research databases, experts, web resources, and books. Self-directedness assures that students will learn the most current information at the time and in the context they need it. The cases and tutorial process must facilitate collaboration among students and among students and the faculty tutor, just as would occur in practice among the treatment team.
5. Content knowledge must be integrated and applied to the patient's clinical problem in order to achieve a deep understanding of the material. Newly acquired knowledge must be applied to the case to test the hypotheses and consider what might need to be changed or what additional learning is needed.
6. Students must practice reflection. Students must reflect on what they have learned as well as engage in a process of self-evaluation and giving feedback to others. Reflection includes the tutorial group's critical analysis of its process of working together and an opportunity to engage in peer and self-evaluation.
7. Learning must be structured in such as way as to be relevant to students' future practice in order to be inherently motivating. PBL involves students in working through patient problems.

8. Learning must occur in the context of small group tutorials facilitated by a tutor. The tutor's skill in working with the PBL tutorial group is fundamental to its success. The tutor's role is to function as a metacognitive guide and generally not as a teacher of information. Rather, the tutor facilitates the group so that they come to accurate conclusions themselves.
9. Assessment methods must reflect PBL goals of problem solving, application of information to the clinical case, self-directed learning, and collaborative team work.

Review of the Empirical Literature on Problem-Based Learning

The empirical literature on PBL outcomes includes several meta-analyses (Gijbels et al., 2005; Newman, 2003; Vernon & Blake, 1993) and systematic reviews of the empirical research evaluating PBL outcomes; (Albanese & Mitchell, 1993; Caterina & Stern, 2000; Colliver, 2000; Smits, et al., 2002); outcome research comparing PBL curricula and traditional educational curricula; (Distlehorst, Dawson, Robbs, & Barrows, 2005; Distlehorst & Robbs, 1998; McParland, Noble, & Livingston, 2004; Miller, 2003; Moore et al., 1994; Nandi, Chan, Chan, Chan, & Chan, 2001; Richards et al., 1996) and a significant number of research publications investigating PBL outcomes including test scores, student satisfaction, ratings of student performance in clinical clerkships, critical thinking, and clinical reasoning. There is also research investigating independent variables of PBL such as tutor expertise, student characteristics, and PBL case design. A noteworthy number of commentaries have been published critiquing the appropriateness of the research methods used in outcome studies and of the meta-analyses and systematic reviews in

particular (Albanese, 2000; Bruhn, 1997; Colliver, 1999; Farrow & Norman, 2003; Norman, 2002; Norman & Schmidt, 2000; Vroman & McRae, 1999).

Despite the fact that several systematic reviews and meta-analyses have been conducted on PBL programs, the research leaves considerable gaps in our understanding of the instructional practices in PBL that may or may not produce beneficial educational outcomes (Newman, 2003). Newman (2003) and others attribute the gaps to the limiting criteria used in the systematic reviews and meta-analyses that severely restricted which PBL programs were included; the exclusive focus on the accumulation of knowledge as an outcome measure for the success of PBL and the exclusion of other outcomes that may be more appropriate to PBL; and, the absence of descriptions of the PBL programs under study. Newman (2003) suggests that the answer to the dilemma regarding inclusion criteria can actually be addressed by creating inclusion criteria based on the nature of the PBL intervention or program. This in itself is problematic. As Barrows (1986; 1998) so frequently pointed out, PBL programs vary greatly, complicating this endeavor. Barrows (1998) and Newman (2003) suggest that Barrows's (2000) criteria for analyzing PBL programs be used as a conceptual framework to classify the different instructional practices in PBL so that the impact they may have on outcomes could be more appropriately studied.

Review of the Empirical Literature Related to PBL Outcomes

Empirical research on PBL has examined a number of outcomes and some of the independent variables. Outcome research and the systematic reviews and meta-analyses that have been conducted have primarily focused on students' accumulation

of knowledge and performance on content knowledge and certification examinations; student satisfaction with the PBL method; ratings of students' performance on clinical fieldwork; how effectively students are able to identify learning issues from a PBL case as compared to faculty identified learning objectives; students' critical-thinking and clinical-reasoning abilities; and, students' attitudes toward and interactions with patients (see for example, Al-Shaibani et al., 2003; Dolmans & Wolfhagen, 2005; Hmelo-Silver, 2004; Koshmann, Glenn, & Conlee, 1997; Richards et al., 1996; Smits et al., 2002; Van den Hurk, Dolmans, Wolfhagen, & Van der Vleuten, 2001). Empirical studies also examined independent variables such as tutor content expertise and the design of cases and student characteristics such as entrance qualifications and learning styles (Al-Nasir & Sach-Robertson, 2001; AlShaibani et al., 2003; Dolmans & Wolfhagen 2004; 2005; Smits et al., 2004).

The PBL research indicates mixed results in students' performance on certification and content knowledge tests (Colliver, 2000; Distlehorst et al., 2005; Newman, 2003). However, research consistently indicates that overall, students of PBL are significantly more satisfied with the learning processes, perform better on clinical fieldwork, experience better team collaboration and interactions, and view patients with a more humane attitude. Research findings also conclude that students perceive their skills in clinical reasoning and critical analysis to be improved as a result of PBL as compared to students' perception of those skills resulting from traditional educations.

There are several shortcomings in the body of PBL empirical research. First, the instructional practices used and the design of the PBL programs under study were

rarely if ever described; therefore, it is impossible to know what instructional practices in PBL may or may not have influenced the outcomes. Second, although the research examined critical thinking and clinical reasoning, it was primarily through the students' perceptions of their abilities in these skill areas. One study however, examined the types of clinical reasoning processes as defined by Mattingly and Fleming (1994) that students used when solving case problems (Neistadt, 1996). Third, the outcome measures used in most PBL research are unrelated to outcomes of PBL as defined by Barrows (1985) and Barrows and Tamblyn (1980). Finally, *almost no research exists pertaining to students' use of EBP in either PBL or* traditional educational programs. This is remarkable given the emphasis on EBP in health care education.

Several of the published PBL studies linked the PBL tutor's skill and/or the instructional practices used by facilitators to PBL outcomes when discussing the research findings. However, no studies examined the instructional practices that may have influenced outcomes as the research question or methodology.

Accumulation of Knowledge in PBL

Empirical research has examined the efficacy of PBL for facilitating content knowledge learning. The literature includes several metaanalyses (see for example, Gijbels et al., 2005; Newman, 2003; Vernon & Blake, 1993) and systematic literature reviews of the empirical research (see for example, Albanese & Mitchell, 1993; Caterina & Stern, 2000; Colliver, 2000; Newman, 2003; Smits et al., 2002). The results of these systematic reviews, metaanalyses and single research studies were inconsistent and inconclusive with regard to performance on content knowledge and

certification exams. Students in PBL education programs were found to fare somewhat less well, about the same, or better than students in traditional education programs on these types of tests.

Published critiques of the metaanalyses and systematic reviews seek to explain the disparity found in the results. First, they lacked a description or study of the PBL and instructional practices that may have influenced outcomes (Barrows, 1998; Newman, 2003; Smits et al., 2002). Second, the assessment measures, consisting primarily of content knowledge tests and other nonPBL outcomes such as "patient health" (Newman, 2003; Smits et al., 2002), clerkship performance, and student satisfaction (Farrow & Norman, 2003; Gijbels et al., 2005; Newman, 2003; Norman, 2002; Prideaux, 2002; Vroman & McRae, 1999) may have affected the results of the studies. Third, the fact that PBL studies included in the metaanalyses consisted only of PBL medical schools and were severely limited by the inclusion criteria to randomized and clinically controlled studies, may have impacted results. Exclusion of other types of research designs and health education programs potentially restricted the findings of the metaanalyses and systematic reviews. Norman and Schmidt (2000) argue that the use of "simple experimental designs such as RCT [randomized controlled trials] and limiting the manipulation of one variable is doomed to fail" (p. 722). Both can be "misleading" because the effects of the educational context or instructional practices of PBL are not taken into account (Leung, 2002; Prideaux, 2002).

It is argued that limiting studies to randomized controlled trials is neither feasible nor acceptable. Eliminating students' choice of the learning methods they

will engage in an educational program they have already selected is ethically questionable and may not, in fact, be possible (Farrow & Norman, 2003; Prideaux, 2002). Additionally, Norman and Schmidt (2000) contend that random assignment and blindness is impossible to maintain in the educational context. Leung (2002) postulated that perhaps the reason that so many metaanalyses and systematic reviews have been conducted on PBL research is because evidence-based practice was originated at the same University where PBL originated, McMaster University. Metaanalyses and systematic reviews are considered by experts in evidence-based practice to be the gold standard of research evidence. Evidence-based practice organizes research into a "hierarchy" with systematic reviews at the top and "original studies" at the bottom (Sackett et al., 2000; Straus et al., 2005). Only in the recent 2005 publication of the third edition of the authoritative text on evidence-based practice, *Evidence-Based Medicine: How to Practice and Teach EBM* (Straus et al., 2005) was it recommended that this hierarchy be tempered by a consideration of the "best current" evidence at the present time, noting the limitations of randomized and clinically controlled trials for research in certain contexts.

Most of the metaanalyses report effect sizes as a determinant of significance between scores students of PBL programs might earn as compared to scores students in traditional programs might earn. Albanese and Mitchell (1993), for example, determined the effect size by calculating the difference in means of the PBL group of students and the group of students from traditional programs divided by a composite standard deviation. Albanese (2000) himself, in a later publication, critiqued his own previous use of effect sizes in his metaanalysis, stating that to expect significance in

effect size is unreasonable because the degree of change expected of the PBL group is excessive. Albanese (2000) determined that the PBL group would have to move from the bottom 25th percentile to the top 25th percentile of the class in order to demonstrate a significant effect size of d=0.8–1.0. He also argued that both groups of students up to the point of entry into medical school are well versed in traditional instructional methodology through 16 years of academic preparation in traditional educational experiences, and in fact were selected for medical school admission based on their performance in traditional educational programs. To expect them to do better in a PBL program would be unrealistic (Albanese, 2000). Norman (2002) concurs with this analysis, stating "if evaluation is restricted to the central educational outcomes such as performance on licensing examinations, few differences are found. This should not be a surprise" (p. 1560).

However, considerable debate exists in the literature as to how large an effect size is significant enough to warrant converting a curriculum to, or continuing to use PBL methodology. Colliver (2000) believes that a large effect size of d=1.0 should be the minimum effect size expected in order to justify the increased cost of instituting a major curriculum change such as PBL, whereas Albanese (2000) and Bloom (1984) argue that a small effect size of d=0.2 is all that should be required to institute curriculum change to PBL (Newman, 2003). Each author of the various metaanalyses considered a different threshold of effect size significance in their interpretation of results, which influenced their conclusions regarding the benefit and efficacy of PBL.

Barrows (1986; 1998), Smits et al. (2002) and Newman (2003) critiqued the metaanalyses and systematic reviews for their absence of descriptors of the PBL curriculum under study, stating that the programs compared in the systematic reviews have little in common with one another and many do not resemble "authentic PBL" with its specifically defined objectives and essential instructional characteristics. Norman and Schmidt (2000) point out that there is great diversity inherent in PBL and that as an approach its characteristics cannot be controlled. The authors further suggest that control of PBL curriculum, tutor, and group variables may be undesirable because of the potential to eliminate the effective ingredient.

There is substantial agreement that outcome measures used to evaluate PBL must be appropriate to PBL outcomes (Barrows, 1998; Gijbels et al., 2005; Norman & Schmidt, 2000; Prideaux, 2002). The outcome measures used in PBL research are not consistent with the stated outcomes of PBL. The challenge, however, is the absence of valid and reliable instruments that can actually measure the core concepts and skills embedded within the PBL objectives including evidence-based practice, critical thinking, clinical reasoning, and collaborative problemsolving (Vroman & McRae, 1999). Reliable instruments, however, have been found to measure critical thinking skills and Straus et al. (2005) provide self-evaluation tools that offer good face validity to assess students' use of and tutor's teaching of EBP skills.

Distlehorst et al. (2005) conducted a study comparing outcomes of students' performance on the National Board of Examiner's United States Medical Licensing Examination (USMLE) and clerkship ratings from two curricula within the same medical school: a PBL curriculum using Barrows model and a "standard" curriculum

using traditional teacherdirected methods. The researchers found that students from both curricula did equally well on both measures although students from the PBL curriculum received more clerkship honors (Distlehorst et al., 2005). Distlehorst et al.'s (2005) findings and discussion supported those of Albanese (2000) who posited that students in PBL may not perform much differently than students from traditional curricula on measures of knowledge and clinical skill acquisition, but may perform better on outcomes not measured by these instruments. Distlehorst et al. (2005) state that knowledge and skills alone do not assure that a practitioner will care compassionately for patients and that additional skills are essential to this challenge:

> The ability to integrate, recall, and apply basic and clinical information to the care of the patient using an effective clinical reasoning process; to identify educational needs and obtain the best information to satisfy these needs to meet new problems and stay contemporary; and to work effectively in team situations are all important outcomes for PBL. (p. 298)

These outcomes, while measured in PBL curricula (Distlehorst et al., 2005; Gijbels et al., 2005; McNulty, Crowe, & VanLeit, 2004; Baptiste, 2003) are not measured on the USMLE, by any content-based measures, or in most standard or traditional curricula (Distlehorst et al., 2005; Barrows, 1994).

Students' Performance in Clinical Clerkships

Students in PBL programs performed better in their clinical clerkships than did their counterparts from traditional educational curricula, with one study reporting the additional finding that students from PBL curricula received more clerkship honors (Albanese & Mitchell, 1993; Distlehorst et al., 2005; Richards et al., 1996; Vernon & Blake, 1993). Related to clerkship performance, are the studies examining students' interactions and attitudes toward patients. Students from PBL programs had

a greater affiliation and better interpersonal skills with their patients (Albanese & Xakellis, 2001; Moore et al., 1994; Nandi et al., 2001). Albanese (2000) and Albanese and Xakellis (2001) contend that the improved ability to relate to patients may be reason enough to use PBL despite research findings on content knowledge accumulation, since a primary objective is to graduate students who can care humanely for their patients.

Student Satisfaction with PBL

The empirical research overwhelmingly found students and faculty who engaged in PBL curricula were more satisfied with their educational experience than students and faculty who engaged in traditional educational programs (Albanese & Mitchell, 1993; Norman & Schmidt, 2000; Stern, 1997; Vernon & Blake, 1993). Colliver (2000), a researcher who has criticized PBL for its increased cost, unimpressive results with regards to knowledge accumulation, and its loose connection with sound theoretical underpinnings, still acknowledges PBL to be more motivating, interesting, and challenging in its educational approach to students and faculty than traditional educational approaches.

Student Identification of Learning Issues in PBL

Problembased learning uses carefully crafted clinical cases as the impetus for learning. The cases are presented in a realtolife context using cases that practitioners are likely to encounter in practice. Faculty select and design cases for the learning issues they will elicit through the PBL process. Learning issues are akin to the learning objectives faculty would develop when preparing for a traditional

lecturebased course. Each case is designed to elicit specific learning issues or topics that a lecture may cover in a given class session and, like a traditional lecture, the learning issues for each case are identified by faculty in advance of the PBL tutorial. Through the process of clinical reasoning, critical analysis, and questioning, students in PBL arrive at their list of learning issues or needs based on what they need to learn and the depth at which they need to learn it in order to solve the clinical case problem. Rather than following a teacher-determined outline of the issues and their depth and breadth, students in PBL determine their learning issues along with the depth and breadth at which they need to learn them. Learning issues include background information, hypotheses, research evidence, and theoretical frames of reference, and specific evaluation and intervention approaches.

Research has been conducted to determine if students in PBL were able to generate learning issues similar to those identified by faculty. Al-Shaibani et al. (2003) examined the degree of congruence between student-and faculty-generated learning issues. They analyzed four categories of learning issues along with students' gender, tutor background, and years of experience to see if there was significance among the variables. The researchers found 54.2% congruence between student-and faculty-generated learning issues. They also found that the PBL tutor's background and years of experience had little impact on the generation of learning issues. However, students identified a higher number of learning issues when their tutors had more than 11 years of clinical practice experience. The researchers also found that the learning issues generated by students in tutorial groups facilitated by nonmedical tutors, had a higher percentage of congruence although the difference was not

significant. Unfortunately, the limits of the study design did not allow for the analysis of what specific instructional practices tutors used, nor did it identify which practices were used by the clinically experienced and nonmedical tutors that appeared to facilitate the generation of a greater number of learning issues and congruence with faculty generated issues. The researchers did not speculate on the relative success of the students' critical thinking abilities or use of EBP; rather they looked exclusively at congruence.

Koschmann et al. (1997) approached the question differently, conducting a discourse analysis of how students in PBL recognized, discussed, and negotiated the generation of learning issues during tutorials. The researchers used three criteria to determine if a student-generated learning issue was deemed by the group to be a relevant topic for learning: "there must be a recognizable knowledge deficiency, the students must see the missing knowledge as relevant to or necessary for the eventual practice of medicine, and, finally, there must be consensus about the timeliness of undertaking the study" (Koshmann et al., 1997, p. 2). The first two criteria for defining and selecting learning issues strike at the very heart of critical thinking and reflective practice. Koshmann et al. (1997) observed that the facilitator engaged students in a kind of reflective questioning, guiding and coaching them to think through and consider how other factors influence the topic under discussion and to elaborate on their thinking and information. Their findings hold particular relevance to this study; namely, that the facilitator's role, chiefly the way in which the facilitator guides and questions students, greatly influenced both the learning issues students generate as well as the process of learning-issue generation. Generating learning

issues requires critical thinking and self-reflection, hence, Koshmann et al.'s (1997) study highlights the need for studies examining the effect that facilitators' instructional practices have on PBL outcomes.

Van den Hurk et al.'s (2001) research sought to discover how many learning issues students identified could be classified as scoring *low*, *moderate* or *high* on three characteristics: (a) denoting a topic containing a keyword; (b) describing issues concisely; and, (c) presenting learning issues that are sufficiently unambiguous that all members interpret it in the same way. Van den Hurk et al. (2001) found that most of the learning issues identified by students were formulated ambiguously and were not concise, with only 20% to 30% of them meeting criteria for unambiguousness. In their discussion, the researchers observed that the learning issues that scored *high* on all three criteria tended to be more hypothesis-related in that they questioned and postulated about the impact one factor had on another factor in the case. This kind of question is specifically called a "foreground" question in EBP, a question that asks the student to develop a hypothesis questioning the relationship between specific cues or factors in the case. Although Van den Hurk et al. (2001) did not directly discuss EBP, this observation is important given that a desired outcome for PBL is EBP. One questions the utility of Van den Hurk's (2001) conclusions when viewed in light of Koshmann et al.'s (1997) discourse analysis: that precise clarity in learning issue generation only emerges following detailed examination of the group's discussion over time. Students' discussions when generating learning issues appear disorganized and chaotic, but that very type of "disorganized" discussion is needed in order for students to get to the precise definition of the learning issues (Koshmann et al., 1997).

In occupational therapy, Stern and D'Amico (2001) solicited "students' perceptions of the extent to which facultygenerated learning objectives were addressed in a PBL course" (p. 455). They divided the occupational therapy students into four tutorial groups, each facilitated by a clinical expert trained in tutor facilitation with students randomly assigned for age, gender, and GPA. Students' perceptions were solicited following each of four cases. The researchers found no significant difference in average ratings across the four groups in all four cases. They also found that a high degree of consistency occurred between the learning issues identified by students and those identified by faculty. Stern and D'Amico (2001) concluded that even though the four tutorial groups consisted of different students facilitated by different tutors, each group covered the same content.

Development of Evidence-Based Practices in PBL

Little research has been conducted on the effectiveness of PBL instructional practices and the effects they may have on teaching or practicing EBP. One study conducted by Shin, Haynes, & Johnson (1993) found that graduates from a PBL medical school were more current in their knowledge of hypertension interventions than were graduates from a traditional medical-school curriculum. These researchers analyzed the limitations of their study and the literature on the efficacy of PBL programs concluding that the difference was "most likely due to differences in the approach to undergraduate [entrylevel] education" (p. 975). They documented that graduates of the PBL program learned through inquiry and identification of learning issues. "Students must identify areas of deficiency in their own performance, find appropriate educational resources, critically appraise these resources, evaluate

personal learning progress and apply newly acquired knowledge and skills in solving patient problems" (Shin et al., 1993, p. 975). Students felt that PBL had prepared them to acquire the tools to continue their own education (Shin et al., 1993). These findings indicate that PBL was effective in facilitating students' active inquiry and critical analysis of new information and research evidence with regards to a specific, although common, medical condition. Shin et al. (1993) concluded that entrylevel education should prepare students to learn throughout their professional lives rather than simply acquire content knowledge and current skills.

Additionally, four of the research studies on PBL programs analyzed in Vernon and Blake's (1993) metaanalysis provided information and data on the students' use of learning resources. Students involved in PBL demonstrated greater independence in learning than did students in traditional programs as indicated by their greater emphasis on journals and searches for information, greater use of the library, greater use of self-directed versus faculty-directed readings, and increased perception of their own competency in inquiry. Although Vernon and Blake (1993) did not specifically analyze the *PBL* programs for students' *EBP* as an outcome, they found that PBL students demonstrated an advantage over traditional students in their pattern of resource use, specifically students' increased independence and inquiry into the research literature, a trademark feature of EBP.

Development of Critical Thinking, Reflective Practice, and Clinical Reasoning in PBL

In the empirical research, critical thinking, and clinical reasoning, are terms often used interchangeably. The findings relevant to critical thinking, clinical

reasoning and EBP skills are embedded in the details of the research results and discussions. One challenge to researchers investigating the development of critical thinking, reflective practice, and clinical reasoning is the absence of valid, reliable instrumentation to measure these constructs. The *WatsonGlaser Critical Thinking Appraisal* (Watson & Glaser, 1980) and *The California Critical Thinking Skills Test (CCTST)* (Facione, 1990b) were the two critical-thinking instruments found most frequently in the literature. Other instruments found were developed by the researchers themselves based on various critical thinking theories.

Much of the empirical research that has been conducted on critical thinking has been from the students' perspective of changes they experienced in their critical-thinking skills (see for example, Biley & Smith, 1998; Birgegard & Lindquist, 1998; Pang et al., 2002; Stern, 1997). Some studies, however, used systematic methods of measuring critical thinking or reflection (see for example, Doucet et al., 1998; Giancarlo & Facione, 2001; Lowe & Kerr, 1998) although only Doucet et al. (1998) examined critical thinking in the context of PBL.

Stern (1997) conducted research on student satisfaction following the introduction of a PBL course in an occupational therapy program. Students reported that the PBL course improved their critical thinking and EBP; that it "strengthened their ability to think through and synthesize the various issues of concern in a case . . . provided a structure for thinking about various decisions and considerations," and "*realized the impact of personal biases on understanding and reasoning through* cases" (Stern, 1997, p. 594). A highlight of Stern's (1997) research was that students identified specific PBL instructional practices that contributed to these changes: peer

discussion and brainstorming, the focus on relevant cases as the primary source for learning, and emphasis on insight into individual behavior.

Research conducted by Pang et al. (2002) in Hong Kong studied the introduction of PBL into a nursing program. These researchers used the developmental action inquiry method to simultaneously study and implement a PBL curriculum. Two inquiry groups were studied: PBL tutors and students. The authors specifically examined the students' perspectives on learning. The researchers documented student feedback indicating that a paradigm shift had occurred in the student groups from teachercentered to studentcentered learning, from valuing individual learning to valuing cooperative group learning, and from theorybased to practicebased learning. Pang et al.'s (2002) findings support the idea that a transformation in the dispositional attitudes required for critical thinking through the introduction of PBL methodology could be achieved.

Birgegard and Lindquist (1998) surveyed medical students' opinions of their medical education in a Swedish medical school before and after the implementation of a PBL curriculum into the otherwise traditional, lecturebased curricula. PBL was the only change made in the curriculum. Students were asked to identify the extent to which the medical school "encouraged independent critical thinking, problemsolving skills, decisionmaking, studying outside the textbook," (p. 46) and other learning behaviors valued by higher education faculty. They found a significant difference in seven of the nine items on the survey following the introduction of the PBL curricula: "problem solving method of working; formulation and definition of problems; study of literature other than textbooks, decisionmaking and the study of literature for

solving problems" (Birgegard & Lindquist, 1998, p. 49) were noted to improve as a result of PBL. Only the two items "study of details and study for examinations" did not improve in students' estimation. It is significant to this research that the changes students observed in their own learning as a result of PBL consisted of improved skills in critical thinking and in the use of specific EBP strategies to solve clinical problems and make clinical decisions. Unfortunately, the specific instructional practices facilitators used in the curriculum were not described, so it is not known what specific PBL instructional practices may have contributed to these changes.

Albanese and Mitchell (1993) in their metaanalysis found that students in PBL programs were better at problem formation than students from traditional programs. Problem formation is the critical initial step in the progression of critical thinking as defined by Facione (1990a) and Elstein et al. (1978). Similarly, Doucet et al. (1998) found that graduates of a PBL program demonstrated better clinical reasoning as indicated on a systematic measurement of clinical reasoning than did graduates from a traditional, lecturebased medical program.

Kamin et al. (2001) define critical thinking as a construct encompassing self-directed learning, clinical reasoning, and creative thinking, all reflective of PBL goals and objectives. These researchers used content analysis "to determine if PBL discourse could be coded for critical thinking, if the coding was reliable, and to determine whether a critical-thinking ratio would provide a valid measure to compare PBL groups" (p. 27). The researchers used the levels of critical thinking organized into "deep" learning for the higher levels of critical thinking (exploration/hypothesis generation, application, integration) and "surface" level learning for the lower levels

(identification, description, exploration) of learning as a coding guide. Since the researchers primarily addressed the validity of measuring critical thinking using two different types of case presentations in PBL, a video and a paper case, they did not discuss the effectiveness of PBL as an instructional method in and of itself. Rather, they found that critical thinking during PBL discourse could be coded using the levels of critical-thinking framework and that the coding was reliable and capable of detecting differences (Kamin et al., 2001).

The notion that "critical thinking" is akin to "deep" or higher levels of learning is commonly proposed throughout the literature (see for example, Gillespie, 2002; Kamin et al., 2001; Margetson, 1994; Sellheim, 2001). Problembased learning was developed in an effort to facilitate a deeper level of learning than what was found to result from traditional learning methods. Traditional teacherdirected, contentlecture based methods were viewed as limiting learning to surface cognitive levels of recall, rote memorization, and uncritical acceptance of information (Barrows, 1985; Margetson, 1994; Sellheim, 2001).

Margetson (1994) reviewed the literature in higher education to compare the outcomes of higher education to its goals and found that "higher education practice may be predisposed to generating undesirabley surface approaches to learning by students" (p. 7). Lecture methodology was cited as contributing to this finding as it remains the predominant teaching method in higher education despite the fact that it is singularly unmotivating to students. Margetson (1994) further noted that despite faculty's efforts to structure the material, convey enthusiasm and teach higher order

cognitive learning, their efforts are often undermined by their anxiety to "cover the material."

Gillespie (2002), Margetson (1994), and Sellheim (2001) concur with Barrows (1985) that the method and process of learning is essential to learning outcomes; that the process of learning can and does affect the level and depth of learning that occurs. Problembased learning has repeatedly been selected as a preferred educational approach over traditional learning methods because it more effectively facilitates higher orders of cognitive learning, deeper learning, reflective practice, and collaborative problemsolving (Albanese & Xakellis, 2001; Bruhn, 1997; HmeloSilver, 2004; Gillespie, 2002; McNulty et al., 2004; Royeen, 1995; Sellheim, 2001).

Maudsley and Scrivens (2000) examined the instructional practices and context required to teach critical thinking. They reviewed the empirical and theoretical literature on critical thinking and concluded that critical thinking does not develop as a byproduct of subject learning but requires specific instruction. They also concluded that critical thinking can only develop as a result of group discussion. Small groups were identified as an essential context for learning critical thinking because it is only a group that can provide adequate diversity to challenge one's ideas and generate alternative judgments. Although Maudsley and Scrivens (2000) did not specifically speak to PBL tutorial groups, their conclusions are consistent with the goals of PBL and the instructional method of using small tutorial groups as the context for learning.

Facione (1990d) conducted extensive research with over 1,000 college students and found that critical thinking is not a by-product of higher education, rather it needs explicit instruction. There is significant agreement in the literature that critical thinking must be specifically and explicitly taught, and cannot be gleaned from subject-based learning (Dornan et al., 2005; Elstein, 2000; Facione, 1990d; HmeloSilver, 2004; Maudsley & Scrivens, 2000; Norman & Schmidt, 2000; Royeen, 1995).

Review of the Research on Independent Variables in PBL

Tutor Expertise in PBL

A systematic review of the research investigating PBL tutors examined the outcomes of studies on three trends in tutor research: (a) the use of content expert tutors versus non content expert tutors; (b) studies of process variables such as the influence of tutors' characteristics on interactions within PBL tutorial groups; and (c) studies of the relationship between the tutor characteristics and other contextual factors (e.g. the structure of PBL courses, case design, students' level of prior knowledge, and the structure of the curriculum) (Dolmans et al., 2002). Dolmans et al.'s (2002) investigation led to some important findings relevant to this study.

A review of the empirical literature revealed that the effect tutor-content expertise had on student academic achievement (knowledge acquisition as demonstrated on test performance and GPA) was inconclusive. However, when examining tutor content expertise with process variables, some important insights were discovered. Content-expert tutors tended to use their expertise to guide and

direct the tutorial group, whereas noncontent expert tutors tended to use their group process skills to facilitate the learning process. Students were asked which was more effective in a tutor, not surprisingly; they felt that tutors needed both qualities to be effective. Students wanted tutors who possessed content expertise to guide learning-issue identification and process skills to facilitate critical thinking and inquiry (Dolmans et al., 2002). Dolmans et al. (2002) emphasized the need for faculty development and training to accomplish both objectives:

> During these training sessions tutors learn how to stimulate specific kinds of cognitive activities, such as how to actively engage students, how to scaffold *students' learning and how to encourage students' metacognitive strategies.* In the future, more attention should be paid to facultydevelopment strategies in which tutors learn to reflect on their conceptions of the tutor role, on their conceptions about student learning and on their actual behavior as tutors. (p. 178)

Finally, Dolmans et al. (2002) found that contextual factors, particularly case design, curriculum design, and the functioning of the tutorial group, greatly influenced tutor behavior. Dolmans et al. (2002) concluded from this finding that tutor behavior may be partially specific to the individual tutor and partially contextually determined. Dolmans et al. (2002) eloquently articulated the need for further research to obtain "detailed and indepth knowledge" concerning the tutor's instructional practices as they influenced student learning and stimulated "constructive, self-directed, situated or transferdirected, and collaborative learning by students" (p. 178).

Student Characteristics

Some studies examined the impact that student characteristics might have on PBL outcomes. Two are of limited relevance to this research and the others

inconclusive. Al-Nasir and Sachs-Robertson (2001) examined the predictive value of three sets of admission criteria on students' performance in the first year of a PBL designed medical school curricula at the Arabian Gulf University: final high school grades, a written exam in English and in science, and a structured interview with the students' performance in their first year of medical school. The researchers found that only the written science exam correlated with students' first year performance in the PBL program. However, no information was given as to the nature of the written exam, student characteristics, or program characteristics other than it being identified as PBL. The vastly different cultural differences between students and educational programs in the United States and the Middle East, as well as the variations in PBL curricula render these data of limited use.

A second study conducted in the Netherlands by Smits et al. (2004) examined student characteristics including gender, age, years of experience as a physician, university of graduation, and learning style. The participants had completed their entrylevel professional education, were working as physicians and engaged in continuing education. Continuing-education students, experienced in their fields, may have already reached a level of maturity beyond that of students in entrylevel professional programs. In contrast, students involved in entrylevel professional education programs tend to be younger, with the overwhelming majority entering with little life experience or professional work experience. Thus, the study provides little information related to this research.

Green and Ruff (2005) identified self-directedness, assumption of responsibility for learning, and commitment as essential dispositional characteristics

necessary for students' development of EBP. Albanese, Snow, Skochelak, Huggett, and Farrell, (2003) examined the literature in an attempt to identify the personal qualities of students that were relevant to the practice of medicine. They found 87 different characteristics with seven emerging as more compelling than others; "compassion, coping capabilities, decision-making, interprofessional relations, realistic selfappraisal, sensitivity in interpersonal relations, and staying power" (Albanese et al., 2003, p. 317). Each of these studies investigated different aspects of student characteristics, some of which may affect students' performance in PBL tutorials and others relating more to performance as a practitioner. These studies therefore, are of little utility to this research.

Summary

This investigation is informed by the theory and research about PBL, EBP, and Facione's (1990a; 1998) cognitive learning theory of critical thinking. The taxonomy of critical thinking developed by Facione (1990a) and EBP developed by Straus et al. (2005) offer a structure through which inquiry was focused. The empirical research has found that students in PBL develop better critical-thinking skills although this finding is from the perspective of students and faculty and is not corroborated by quantitative data. Little research exists investigating the relationship between the instructional practices used in PBL and its outcomes, although several studies infer the importance of that relationship. Additionally, whether or not PBL facilitates EBP is unknown, with only one study finding that PBL may facilitate better use of a greater variety of resources of information.

CHAPTER III

DESIGN AND METHODOLOGY

Overview

Limited research evidence exists indicating that problembased learning effectively facilitates critical thinking and evidence-based practice. The empirical literature indicates that although students and tutors reported improved critical-thinking skills in PBL, these findings were obtained from students' and faculty's perspectives rather than any quantitative measures of critical thinking (see for example, Birgegard & Lindquist, 1998; Dolmans, Van Luijk, Wolfhagen, & Scherpbier, 2006; Dornan, et al., 2005; Pang et al., 2002; Stern, 1997). None of these studies, however, provided a rich, detailed description of the students' or tutors' definitions of critical thinking or the meaning improved critical thinking held for students' or tutor's PBL experience. Additionally, the exact nature of the facilitator's instructional practices that successfully facilitated students' critical thinking or EBP in PBL tutorial groups remains unknown. The purpose of this study is to identify, analyze, and interpret the instructional practices of problembased learning facilitators, and the critical thinking and evidence-based practices of students as these skills develop over the course of the semester in problembased learning tutorial groups.

Design of the Study

Qualitative Research

Since this study is exploratory and descriptive in nature, seeking to answer "how, why and what" questions, the researcher will use qualitative methodology (Creswell, 1998; Yin, 2003). Qualitative methodology will allow the researcher to fully explore the multiple variables and intricacies of instructional practices that may facilitate the development of students' critical thinking and EBP in the PBL tutorial group environment (Merriam, 1998; Yin, 2003). The naturalistic context of qualitative methodology allows the researcher to investigate the variables in a holistic, indepth manner, while preserving them without risk of controlling or losing the very factors that may contribute to the development of students' critical thinking and EBP (Norman & Schmidt, 2000; Yin, 2003). The insights gained from this exploration will be used to generate hypotheses that may guide future research (Merriam, 1998).

Although the design of this study will use qualitative methods, a quantitative instrument, the *California Critical Thinking Skills Test (CCTST)* (Facione, 1990b), was used to select the sample from the population of student participants through a pre-and post-analysis of *CCTST* scores (see Sample Selection section in this chapter). Interviewing only those students who have demonstrated significant advancement in critical thinking as demonstrated on the *CCTST* will allow specific, indepth exploration of the factors and instructional practices that contribute to the development of critical thinking skills and EBP. Miles and Huberman (1994) suggest linking qualitative and quantitative data when: (a) the research is both confirmatory

and exploratory in nature; (b) when quantitative data can facilitate the qualitative aspect of the study; and (c) to corroborate data by way of triangulation. This study meets all three of these conditions.

Quantitative data will be used to confirm or refute two questions underpinning the research. The first is whether students do, indeed, develop critical thinking and EBP skills in the context of PBL tutorial groups. Confirming the development of critical thinking and EBP is essential to this research and the *CCTST* scores will provide data to answer this question. The second question is whether the PBL facilitator must use specific instructional practices to facilitate the development of these skills. Data from the tutorial group observations, tutor and student EBP self-evaluations, and data from the interviews will answer this question.

Case Study

The research will use a twocase, critical case study design to approach the research questions. The critical case was selected using a preand posttest analysis of the *CCTST*. The case study design is an appropriate empirical method to address the research questions and meets Yin's (2003) criteria for selection of case study methodology: (a) the research will be conducted in a naturalistic and reallife context of PBL tutorial groups; and, (b) the boundaries between the contextual factors, specifically the instructional practices of the facilitator, PBL and outcomes of critical thinking and EBP are not known.

The research questions seek to investigate and provide a rich, description of the contextual factors that contribute to students' development of critical thinking and EBP as these have been relatively unexplored by the PBL empirical research and

have yet to be identified. The case study design allows for triangulation of data from multiple sources in the analysis (Yin, 2003).

Selecting a "critical case" sample was optimal for this research as only those students who made the greatest change in developing critical thinking and EBP skills in PBL were interviewed. The critical case allowed the researcher to keenly focus in on and explore the factors that contributed to the development of critical thinking and EBP skills (Creswell, 1998; Merriam, 1998). The "twocase" study design included students and PBL facilitators from two distinct programs: the occupational and physical therapy programs. The twocase study method offers increased credibility to the research findings (Merriam, 1998; Miles & Huberman, 1994).

Validity and Reliability: Triangulation

"In triangulation, researchers make use of multiple and different sources, methods investigators, and theories to provide corroborating evidence" (Creswell, 1998, p. 202). Triangulating data from multiple sources allows the researcher to test and corroborate the meanings and interpretations emerging from the data and offers validity and reliability to its findings (Miles & Huberman, 1994; Patton, 1990). Triangulating data offers a way to test the plausibility and confirmability of the data and can therefore be used to confirm or refute the researcher's questions and corroborate findings. In triangulation, different sources are used to crosscheck the data because no single source can be trusted to provide a comprehensive picture (Merriam, 1998). In keeping with qualitative research, the multiple sources of data used in this research consisted of observations, interviews, and documents. The combination of data collected from the three sources "increases the validity as the

strengths of one approach can compensate for the weaknesses of another approach" (Patton, 1990, p. 245).

A diverse collection of materials was gathered and used to triangulate and corroborate the data. Data were collected through interviews with the critical case sample, observations of PBL tutorial groups, observer comments and field notes, students' and tutors' self-evaluations of critical thinking and EBP, and document analysis. Documents analyzed include curricular design descriptions for the occupational and physical therapy programs, course syllabi, tutor training manuals, and students' PBL handouts.

Site and Participants

Site

The site selected for this study is a small, faith-based University located in a suburban community in the Northeast. The researcher is employed at the university as the director of the graduate occupational therapy program and, therefore, is afforded access to both the occupational and physical therapy programs. Generally, the researcher in her role as program director directly supervises the full-time faculty member who is the course instructor, who in turn supervises the PBL tutors. The program director also generally assumes responsibility for the overall tutor education and orientation at the beginning of each fall semester and occasionally throughout the year in the context of the regularly scheduled meetings the course instructor holds with the tutors. So as to reduce the potential effect of this bias on the research, the researcher removed herself from all PBL teaching and facilitator supervision

responsibilities for the 2005–2006 academic year. The researcher neither grades students in the physical therapy (PT) program, nor evaluates or supervises PT tutorial facilitators.

The occupational therapy (OT) program is a two-year, full-time graduate program leading to a master's of science degree in occupational therapy (MSOT). The PT program is a three-year, full-time graduate program leading to a clinical doctoral degree in physical therapy (DPT). Both programs enroll students postbaccalaureate and use PBL as the primary method of teaching augmented with additional coursework, laboratories, and clinical fieldwork. The two programs, however, differ in the implementation of PBL, in curricular design, in strategies used to supervise and educate PBL facilitators, and in their respective profession's philosophical values. The two programs share similar policies and structures regarding PBL tutorials:

(1) Students engage in one major PBL course with two to three supporting courses each semester that focus on other areas of professional practice including professional communications, health care practice, and research.

(2) PBL tutorials consist of five to seven students and a facilitator who is a clinical practitioner and adjunct instructor.

(3) The PBL course instructor is primarily responsible for the supervision of the PBL facilitators and is a full-time faculty member.

(4) PBL tutorial groups meet twice weekly for a tutorial session three hours in duration. Both follow similar formats and sequence of the PBL process: *discussion of information and research obtained on the identified learning*

issues from the previous tutorial session; reading the new case/part of case; identifying the learning issues; self-reflection, and group evaluation.

(5) Both programs have a policy that students cannot change tutorial groups. Tutorial group constellation changes each semester.

(6) Roles of PBL facilitators are to facilitate learning, not to directly teach.

Participants

The population of participants consisted of a purposeful, criterion-based, convenience sample of students from the first year, second-semester, entry-level occupational therapy and physical therapy PBL tutorial groups who were invited to volunteer. Prior research has found that students need one course in PBL to adjust to the method and that by the end of their first PBL course, students developed group work strategies, effective and efficient ways to research information, and found ways to cope with the stresses of a demanding professional educational program and PBL (Williams, MacDermid, & Wessel, 2003). The researcher has access to the population by virtue of her employment at the University.

Thirty students (100% of the student participant group) participated in this study. All students were full-time occupational and physical therapy students enrolled in the University for the 2005–2006 academic year, were in the second academic semester of the first professional year of their respective programs, and were in the first-year postbaccalaureate degree. All students had already completed one semester of their respective programs including one semester of PBL tutorial group work.

Occupational Therapy Students. The population consisted of 12 first-year, second-semester occupational therapy students. All of the students are female, 11 are Caucasian, and 1 is Bermudian of African decent. One student participated in the study so she would not feel excluded, but was not included in the critical case sample because she was previously enrolled in a PBL program and had experienced four semesters of PBL before transferring into the OT program. The mean age of the student group is 27.5 years of age with ages ranging from 22 to 42 years.

Five of the twelve occupational therapy students or 42% met selection criteria for the critical case sample. The critical case sample consisted of 10 students, or one-third of the total participant population of 30 students.

Physical Therapy Students. The population consisted of twenty-two first-year, second-semester physical therapy students. Fourteen are female, eight are male. Twenty-one of the 22 physical therapy students are Caucasian and 1 is African American. The mean age of the student group is 24.68 years of age with ages ranging from 21 to 48 years.

Five of the twenty-two physical therapy students or 23% met selection criteria for the critical case sample. The critical case sample consisted of ten student participants, or one-third of the total student participant population of 30.

Occupational Therapy Tutors. Two (100%) of the second-semester occupational therapy PBL facilitators participated in this study. Both are Caucasian and female. The average age is 43 ½ years old and the average number of years of clinical practice experience is 10 ¼ years. Both facilitators have facilitated PBL

tutorial groups at the University for an average of six ½ semesters each. One facilitator is educated at the baccalaureate level, the other at the master's degree level.

Physical Therapy Tutors. Four (100%) of the second semester physical therapy PBL facilitators participated in this study. Two of the facilitators are female, two are male. The average age is 45.75 years old and the average number of years of clinical practice experience is 17.75 years. Facilitators have facilitated PBL tutorial groups at the University for an average of seven ½ semesters each. Three facilitators are educated at the master's degree level, one holds a DPT.

Sample Selection

A pretest and posttest of the *CCTST* was used to select the critical case sample and answer the researcher's question as to whether or not critical thinking developed in PBL tutorials. All students were administered the *CCTST* as a pretest early in the second semester. It was again used as a posttest at the end of the second semester. The scores of the students' pretest and posttest were analyzed. Those students whose scores indicated the greatest change in scores between the pretest and posttest were identified as meeting the selection criteria for the critical case sample and were invited to participate in an in-depth interview regarding their perceptions of the factors and instructional practices that contributed to the change in their skills. The critical case sample could be considered exemplary as students who had accomplished two essential PBL objectives: increasing critical thinking and EBP (Creswell, 1998). The top one third of the 30 student participants or the top 10 students who met the selection criteria were chosen for the critical case sample and interviewed. Five occupational therapy and five physical therapy students met

selection criteria. The ratio of occupational therapy to physical therapy students constituting the critical case sample was not predetermined; the fact that 50% of the critical case sample were occupational therapy students and 50% were physical therapy students occurred by chance.

The California Critical Thinking Skills Test (CCTST)

The *CCTST* is a 34 item, multiple choice, standardized instrument designed to measure the core critical-thinking skills essential in higher education (Facione et al., 2002). The instrument derives its content validity from the taxonomy of critical-thinking skills conceptualized in the *Delphi Report* (Facione, 1990a). The *CCTST* targets its assessment on the core critical-thinking cognitive skills of analysis, interpretation, inference, evaluation, and explanation. The first three subscales are categorized into analysis, inference, and evaluation. The analysis subscale incorporates lower-and higher-order cognitive skills including the ability to identify and comprehend the significance and meaning of multiple types of information as well as being able to identify the inferential relationships among statements and concepts. The evaluation subscale assesses the student's ability to evaluate the credibility of concepts and information, as well as the strength of the inferential relationships. It also assesses the student's reasoning to justify their inferences. The inference subscale examines the student's ability to identify information needed to draw reasonable conclusions, make conjectures, and form hypotheses. It includes the ability to question evidence and alternatives. The final subscales address inductive and deductive reasoning (Facione et al., 2002).

The construct validity and concept definitions of critical thinking as defined in the *Delphi Report* (Facione, 1990a) and in the *CCTST* were reaffirmed in a replication study with 1,169 college students (Facione, 1990c) and again in 1993–1994 in a study conducted by the National Center for Higher Education Teaching, Learning and Assessment (Jones et al., 1995). The *CCTST* derived its content validity from a well-defined conceptualization of critical thinking by a large number of experts in the field using rigorous methodology, which renders it unique among critical-thinking assessment instruments (Facione, 1990c; Facione et al., 2002).

Construct validity of the *CCTST* is also supported by the results of a pretest and posttest study with students at California State University. Facione (1990c) wanted to see if students enrolled in required general education courses specifically designed to teach critical thinking, actually improved students' critical thinking as measured on the *CCTST* as compared with a control group of students who did not take the critical-thinking courses. The differences obtained between the experimental group and the control group were significant at the $p<.01$ level indicating that it is highly unlikely that the difference between the pre and post experimental groups happened by chance. The researchers repeated this experiment again in May and February 1990 with different experimental and control groups of students. The findings of this study remained the same (Facione, 1990c).

Facione (1990c) conducted a number of research studies evaluating the construct and concurrent validity of the *CCTST*. Concurrent validity of the *CCTST* correlated significantly with the pretest groups' college GPA (.002, $p<.001$); verbal SAT scores (.550, $p<.001$); math SAT scores (.439, $p<.001$); and the Nelson-Denny

Reading Test (.491, p<.001) (Facione, 1990d). The *CCTST* does not favor or disadvantage any ethnic or racial group, gender or academic major. However, Facione (1990e) did find a significant correlation of the student's critical-thinking self-esteem and scores on the *CCTST*.

The *CCTST* scores of 1,673 college students tested the instruments internal validity. Norms and percentile ranks were calculated for each subscale as well as the entire test, and included the scores of native and nonnative English-speaking students. The subscales of analysis, evaluation, and inference as well at the inductive and deductive correlate strongly with each other and with the overall *CCTST*. The Kuder-Richardson internal reliability coefficients ranged from .68–.69, supporting the test's *reliability to measure critical-thinking skills (Facione, 1990f). The authors* postulated that one way to increase the test's internal reliability was to increase its length to 62 items, but noted that given the purpose and target audience for the test, this would be unfeasible (Facione, 1990f).

Methods of Data Collection

Observations

Observations provide a method by which the researcher can describe the setting and the activities that take place. Observations also allow the researcher's own perspectives to become part of the data: The researcher used her "personal knowledge and direct experience as resources to aid in understanding and interpreting" the activities and context under study (Patton, 1990, p. 205). The researcher's impressions, reactions, and feelings thus became part of the data

analyzed to understand the instructional practices in PBL and their effects on critical thinking and EBP. Observations are unique in that they permit the researcher to simultaneously glean an understanding of the meaning those activities have for the participants and corroborate the perspectives of the participants with her own experience of the same events and context (Patton, 1990).

During the observations, observer comments regarding the researcher's feelings, reactions, initial interpretations, hunches, and hypotheses about the context, activities, and the participants were recorded. The researcher completed field notes following observations adding additional observer comments as appropriate. The simultaneous collection and analysis is a hallmark of qualitative research with field notes and observer comments comprising preliminary analysis of the data (Merriam, 1998).

Ethnographic Observations

The researcher originally intended to use a categorical observation checklist as a guide to collect data on instances evident of critical thinking and EBP during the tutorial observations. Categorical observations were initially selected to "narrow the lens" and focus only on the primary research questions of this study including the events, activities, and instructional practices that indicate instances and patterns of critical thinking and EBP (Creswell, 1998). The categorical observation checklist included behaviors indicative of critical thinking and EBP using the domains of EBP outlined by Straus et al. (2005) and in Facione's (1990a) taxonomy of critical-thinking skills and subskills. Although no psychometric studies have been conduced on the instrument it could be said to have face validity given its direct descendence

from Facione's (1990a) and Straus et al.'s (2005) strong theoretical frameworks. However, within the first few minutes of the researcher's tutorial group observations, she found the categorical observation guide to be unduly cumbersome and inapplicable to what was occurring in the tutorial groups. She quickly abandoned the use of the checklist in favor of open-ended ethnographic observations instead. The researcher took detailed notes on the observations of what students and facilitators said and did in the tutorial group, omitting only academic content details. Ethnographic observations allowed the researcher to gain greater insight into the culture of each tutorial group, opening her vision to understand the impact that individual disposition, emotional commitment to tutorial groups, and culture had on the development of students' critical thinking and use of EBP.

The researcher attempted to be as passive and unobtrusive an observer as possible so as not to influence the instructional practices of the PBL facilitator or practices of the student participants. However, she did find herself at times reacting to events in the tutorial and sometimes falling into the role of participant either because she was invited to do so by the facilitator or students, or because she became tempted by her expertise in occupational therapy, EBP and/or the PBL tutorial process. At these times, the researcher was careful to record her reactions, instances of participation, and even the occasions where she was tempted to participate in her observer comments for later analysis.

Interviews

Interviews provide data from the participants and lend insight to the meaning of activities and events from the participants' perspective. Interviews are used in

qualitative research to discover what cannot be observed—to find out what is in the participants' minds (Patton, 1990). Since researchers cannot understand what meaning an event or activity may have for the participants from observations, interviews are necessary to discover the participants' perspectives. Yin (2003) identifies the interview as "one of the most important sources of case study information" (p. 89). It is through the interview that the line of research inquiry can be followed.

An interview guide was used in this study. Patton (1990) states that "interview guides provide a framework within which the interviewer develops questions, sequences those questions, and makes decisions about which information to pursue in greater depth" (p. 285). The advantage of using an interview guide is that it provides flexibility to explore subjects that come up in greater depth or pursue new areas of inquiry spurred by the conversation, yet it keeps the focus on the line of inquiry. The guided interview allowed students to tell their own story as to how they made the transformation to greater critical thinking and EBP while also allowing the pursuit of unanticipated topics (Merriam, 1998; Patton, 1990). (See, Appendix A for Interview Guide).

Only those students selected for the critical case study were invited to participate in the individual interview. The interview, a "guided conversation" of open-ended questions, was designed to discover, what in the students' estimation, contributed to their development of the two essential PBL objectives; critical thinking and EBP (Yin, 2003). Interviewing the group of students that made the greatest changes in their critical thinking in PBL tutorials allowed the researcher to pursue

"how" and "why" this occurred, a question not yet answered in the empirical research. The interview was used to explore, in depth, the factors and instructional practices as the students experienced them.

Document Analysis

Data from documents can be collected without affecting what happens in PBL tutorials and thus, are considered stable and unobtrusive measures (Patton, 1990). Documents reveal goals and decisions that cannot be observed by the researcher or revealed by the participants. Documents can also inform the researcher about important questions to pursue through observations and interviews (Merriam, 1998; Patton, 1990). The data obtained from documents were used to augment descriptive information, to corroborate findings from interviews and observations, and to verify emerging hypotheses.

Curricular, course, and program documents provided a paper trail to increase the researcher's understanding and knowledge about the instructional practices, critical thinking and EBP in PBL in the OT and PT programs. Several documents were analyzed as part of the triangulation of data. First, PBL course syllabi were analyzed for their expectations and goals regarding critical thinking and EBP as well as for indications of instructional practices. Secondly, the occupational and physical therapy program PBL facilitator training and/or orientation manuals and curricular documents were analyzed with attention to goals, expectations, and strategies for teaching/learning critical thinking and EBP. Finally, student handouts produced for PBL tutorials were analyzed. Handouts are a primary source for determining the

type, variety, number, and information sources students used to pursue their inquiry and thus are excellent indicators of the students' use of EBP strategies.

Self-Evaluation of Evidence-Based Practice

The *Self-Evaluation in EBP* was originally designed by Straus et al. (2005) as a qualitative measure consisting of open-ended questions for narrative comments and examples. Straus et al. (2005) developed their evaluation as the final, self-reflective step in the process of teaching and learning EBP. The evaluation, designed for both the student and the teacher, consists of a series of semistructured questions in five domains: (a) asking answerable questions; (b) evaluating performance in searching for evidence; (c) critically appraising evidence for its validity and utility; (d) integrating evidence and the patient's values, goals, context, condition; and (e) evaluating whether practice improves as a result of EBP. (See Appendix B for *A Self-Evaluation in EBP* and Appendix C *A Self-Evaluation in Teaching EBP*). The credible expertise in the area of EBP and in teaching EBP of the instrument's authors gives the instrument its face validity although no psychometric research exists on the instrument.

To answer the question as to whether or not students' use of EBP increased in the context of PBL tutorials, and make the instrument a quantitative measure for statistical analysis, the *Self-Evaluation in EBP* questions were modified by including a seven-point Likert scale. The researcher chose a seven-point scale because the scores for self-evaluations tend to cluster at the higher ends of the scale and she wanted a wider distribution of scores. To suit the University context, the researcher also modified the language in the "searching for evidence" domain scale. Straus et

al.'s (2005) scale in this domain utilized library jargon unfamiliar to students or facilitators and focused exclusively on Medline searches available to practitioners.

Students and the PBL facilitators evaluated their performance on EBP at the beginning of the semester and again at the end of the semester to determine differences in pretest and posttest *Self-Evaluation of EBP.*

Analysis and Interpretation

Analysis in the Field

Several strategies are presented in the literature as possible ways to analyze qualitative data. While strategies differ, there is agreement that analysis of data in the field and analysis after data collection are intimately connected in qualitative research (Creswell, 1998; Delamont, 2002; Merriam, 1998; Miles & Huberman, 1994). Delamont (2002) reminds us "that the 'analysis' of qualitative data is a process that continues throughout the research: it is not a separate, self-contained phase" (p. 171). Merriam (1998) best illustrates the continuous relationship between analysis in the field and after data collection in her articulation of the "enlightened" qualitative researcher:

> You sit down at the dining room table with nothing more than the transcript of your first interview, or the field notes from your first observation, or the first document you collected. You review the purpose of your study. You read and reread the data, making notes in the margins to comment on the data. You write a separate memo to yourself capturing your reflections, tentative themes, hunches, ideas, and things to pursue that are derived from this first set of data. You note things you want to ask, observe, or look for in your next data collection activity. After your second interview, you compare the first set of data with the second. This comparison informs the next data collected, and so on. Months later, as you sit down to analyze and write up your findings, you have a set of tentative categories or themes—answers to your research

> questions from which to work. You are organizing and refining rather than beginning data analysis. (pp. 161–162)

The researcher began the process of analysis in the field during the observations and interviews. The researcher wrote her questions, thoughts, feelings, and reactions in the margins of the notes she took while observing tutorial groups and interviewing students. The researcher transcribed the ethnographic observations and interviews in a continuous sequence immediately after they had occurred and included further thoughts, questions, reactions, and feelings in the "observer comment" column of the transcriptions. Hence, analysis in the field continued into the immediate next phase of the data collection—data analysis phase. This process allowed the researcher to further focus future observations and interviews in order to obtain more information on unanswered questions noted in the first analysis.

The continuous analysis of data and reflection back to previously collected data is called the constant comparative method and was used in this study (Glaser & Strauss, 1967). The constant comparative method allows for the simultaneous analysis and coding of data and creation of categories that capture its pertinent meaning and characteristics (Merriam, 1998).

The Constant Comparative Method

The data were systematically analyzed to quantify and qualify the frequency and variety of "messages" regarding critical thinking and EBP embedded in the documents, interviews, and observations (Merriam, 1998). These were then categorized into like properties and themes. The researcher then developed tentative links or hypotheses describing the relationship between the categories and properties

(Glaser & Strauss, 1967). Each set of data was compared to the other data sets as they were collected. As each piece of data was collected, it was reviewed using the following sequence of strategies: First, the data were reviewed and notes, observer comments, reflections, and questions were jotted down in the margins as the researcher began to question and analyze the data. The observer comments and notes isolated and identified the most salient data. Second, observer comments were reviewed, comparing one to the next, grouping the notes and comments that appeared to be like each other into themes and categories. Third, the next data set were analyzed similarly, comparing them to the groupings previously identified. As the process of constant comparison of data occurred, patterns (i.e., commonalities and differences) emerged and categories were formulated relevant to the purpose of the research (Merriam, 1998). Through constant comparison, the researcher began to make generalizations about the data and formulate hypotheses about the relationships between the variables that were then tested in the next step of data collection as a way toward hypothesis or theory generation (Merriam, 1998; Miles & Huberman, 1994).

Analysis after Data Collection

The three primary challenges of final data analysis are: (a) coding the data into meaningful themes; (b) establishing validity and reliability; and, (c) developing theoretical insight and interpreting the data (Creswell, 1998; Delamont, 2002; Merriam, 1998).

To develop codes, the researcher identified recurrent patterns as well as instances that ran contrary to those patterns (Delamont, 2002). The codes provided a thick, rich description of the PBL culture and educational approach under study

(Delamont, 2002). Codes were derived from themes that emerged from the participants' responses, her own perceptions, and from the theoretical literature on critical thinking, PBL, and EBP. Merriam (1998) considers all three sources, (the researcher, the participants, and sources external to the study such as the literature), to be essential to the process of developing codes. Initial codes reflected the researcher's perspective of what she saw in the data through constant review and reflection of the data, observer comments, and fieldnotes. Codes were then compared and refined according to themes identified by the participants themselves in the interviews and comments on the *Self-Evaluations of EBP*. Codes were further refined using the theoretical literature on critical thinking, EBP, and PBL.

The researcher took care to make sure that the coding met Merriam's (1998) criteria for determining the efficacy of categories and codes: (a) codes reflect the research purpose and questions; (b) codes are exhaustive, all relevant data can be placed into a category or subcategory; (c) codes are mutually exclusive, one unit of data fits into only one category; (d) codes are sensitive and understandable to persons outside the research; and (e) codes are conceptually congruent, the same level of abstraction characterizes categories at the same level.

Two common strategies are used in qualitative research to make sure the data are reliable and valid: triangulation and respondent validation (Delamont, 2002). Respondent validation refers to checking with participants to see if they agree with the validity of the analysis being developed. The researcher was only able to do this in the context of the final stage of the interviews, which was the final stage of data collection, so as not to contaminate participants' behaviors and responses during data

collection from other sources. The disadvantage of seeking respondent validation at this point in time was that categories derived from the interviews themselves could not be included and the academic calendar and unavailability of the PT participants during the summer months prohibited seeking respondent validation following data collection. The OT participants were available during the summer months and respondent validation was sought following data collection.

Triangulation is used most often in qualitative research to cross-check and validate the data. Between methods, triangulation used in this study involved collecting and comparing data on something with more than one method (Merriam, 1998). For example, data on critical thinking were collected through the *CCTST*, observations, interviews, and document analysis. Data on EBP were collected through observations, interviews, document analysis, and the *Self-Evaluation of EBP* from the perspective of both the facilitators and the students.

Since this study was a two-case, critical case study, analysis was conducted within each case, the occupational therapy and physical therapy programs, and across the two programs. Curricular and course documents provided rich contextual data on the variables that had a bearing on the case and the two outcomes under study—critical thinking and EBP. The between-case analysis further provided validation and reliability of the findings.

Generating theory and making inferences was the final step in the analysis. The researcher embarked on this process by scrupulously and honestly "interrogating the data" (Delamont, 2002, p. 177). Codes, themes, and categories were questioned, inferences made, and hypotheses formulated postulating the relationships between

categories and characteristics. The researcher asked which findings supported and which did not support the developing arguments and hypotheses. An advantage to interrogating negative findings (i.e., those that do not support one's arguments) is that it may "lead to refining the initial theoretical position, or may reveal that the negative incident is a genuinely isolated exception that 'proves' the initial rule" (Delamont, 2002, p. 182).

Analysis of Quantitative Data

Descriptive statistics were compiled for participants' demographic information and for scores on the *CCTST*. The means and standard deviations for the seven-point Likert scales of the *Self-Evaluation in EBP* and *Self-Evaluation in Teaching EBP* were calculated.

Individual student's gain scores (differences of means between pretest and post test scores) and effect sizes were used to select the critical case sample and to answer the research question: "Do student improve their critical thinking in PBL tutorials?" The Cohen's *d* effect size is a statistical indicator that measures the extent of the intervention result independent of sample size (Cohen, 1988; Thalheimer & Cook, 2002). Cohen's *d* was obtained by calculating the difference between the pretest and posttest means divided by the composite standard deviation. Cohen's *d* yields an effect size with a standardized interpretation ranging from a small effect ($\geq$0.15 and <0.40); a medium effect ($\geq$0.40 and <0.75); or, a large effect ($\geq$0.75 and <1.10) (Cohen, 1988; Thalheimer & Cook, 2002). An additional effect-size calculation, Pearson's *r* correlation, was utilized to calculate the size of the change

from pretest to posttest of the *CCTST* and the *Self-Evaluation of EBP* in the pooled group of students.

Procedures

The research progressed through a sequence of steps: First, entry and permissions to conduct the research were obtained. Second, students were administered the pretest of the *CCTST*, and students and facilitators were asked to complete the *Self-Evaluation of EBP* as a pretest. Simultaneously, the first observation of the PBL tutorials began and continued twice more throughout the semester. Documents were collected and data analyzed using the constant comparative method throughout the data collection process. (See the Data Analysis section of this chapter). Toward the end of the semester, the participants were administered the posttest of the *CCTST* and the critical case sample was selected using these results. The posttest of the *Self-Evaluation of EBP* was also administered. Finally, the researcher interviewed the critical case sample and the sample participants were given the opportunity to review and comment on the interview transcripts. All data were then analyzed.

Entry

The researcher is employed as the director of the graduate occupational therapy program at the university in which this study was conducted and is therefore afforded access to the population. The researcher neither grades students in the PT program, nor evaluates or supervises PT tutorial facilitators and has completely

removed herself from teaching in any of the PBL courses or supervising any of the PBL facilitators in the OT program for the academic year 20052006.

Permissions

Access to the tutors and tutorial groups was first discussed with the Chair and Director of the PT Program and the course instructor of the PBL courses in the OT and PT programs. The researcher obtained permission to present the research and request the participation of students and tutors prior to any contact with students or tutors. Permission was first obtained from the physical therapy program director and the occupational and physical therapy PBL course instructors to approach the tutors and students about the research. Tutors were then contacted by email, telephone, and/or in person to begin the process of obtaining permissions and requesting participation. Once the PBL tutors gave permission for the researcher to enter the tutorial group, the researcher then introduced the research process to each tutorial group of students and tutors and discussed how the critical case sample would be selected, requested participation, and obtained informed consent.

Students were informed that the critical case sample would be selected from the group of students who made the most gains in their *CCTST* and *Self-Evaluation of EBP* scores. Since scoring of the *CCTST* is done by the publisher, the scores or difference between the pretest and posttests was not known to the researcher until all the observations of tutorial groups were completed. The researcher deferred scoring the *Self-Evaluation of EBP* until that time as well, so as to remain blind to who met selection criteria for the critical case sample until all the tutorial group observations

were completed. This decreased opportunities for bias toward individual students during the observations.

Students were asked to sign a letter of informed consent to participate in the first phase of the research which consisted of taking a pretest and posttest of the *CCTST* and agreeing to be observed in their PBL tutorial groups. Although the letter of consent included a description of the second phase of the research, a separate letter of informed consent for the interview process was given to only those students selected for the critical case study interviews. Students invited to participate in the interview phase of the research were asked to sign a letter of consent to participate in the interview.

The dissertation research proposal was submitted to Fordham University's Institutional Review Board (IRB) prior to approaching PBL facilitators or students for permission to participate. Additionally, the proposal was submitted to the IRB of the faith-based University for approval.

Self-Evaluation in EBP and Self-Evaluation in Teaching EBP

All students and tutors were asked to complete *A Self-Evaluation in Evidence Based Practice* (for students) and *A Self-Evaluation in Teaching Evidence Based Practice* (for tutors) at the beginning and at the end of the semester. These instruments focus only on the use of and/or teaching of EBP and provided additional data on the students' and tutors perceptions of their own skill in EBP and teaching EBP. These data were used to corroborate data collected during the observations.

Observations for Critical Thinking and Evidence-Based Practice

The researcher observed each PBL tutorial group on three separate occasions over the course of the semester using ethnographic observations: Once early in the semester, once approximately midsemester, and last, toward the end of the semester. Each PBL tutorial was observed for its entire 3-hour session on the three separate occasions throughout the semester.

Selection of Critical Case Sample

A pretest and posttest of the *CCTST* was used to select the critical case sample. All student participants were administered the *CCTST* as a pretest early in the second semester, and again as a posttest at the end of the second semester. The scores of the students' pretest and posttest were analyzed and those students whose scores indicated the greatest change between the pretest and posttest were identified as meeting the selection criteria for the critical case sample and were invited to participate in an indepth interview.

All students' tests were given numerical codes to protect confidentiality. Tests were kept in a locked cabinet for safekeeping.

Interview of the Critical Case Sample

Students invited to participate in the interview were asked to sign a letter of informed consent prior to the interview. The researcher arranged for interviews at a time and oncampus location convenient to the student. Four of the ten students however, were unavailable for inperson interviews because they had started their clinical fieldwork experiences and therefore were interviewed over the telephone.

The interview guide was used to conduct the conversation and students were interviewed individually for 30–60 minutes.

Detailed notes were taken of the interview or they were tape recorded. All interviews were transcribed and the transcriptions were distributed to the students to check for accuracy. Students were asked to return the transcriptions to the researcher within a specified timeframe arranged between the student and the interviewer. Students were informed that if they did not return the transcripts by the agreed upon due date, it would be assumed that the transcript accurately reflected the interview. The researcher sent students an email reminder to return transcriptions two days prior to the due date.

All personal and identifying information was deleted from the transcriptions and students were given numerical codes to protect confidentiality. Tape recordings and transcriptions were kept in a secure location.

Document Analysis

Documents were constantly analyzed and compared to the data as they were collected during the observations and interviews. Document analysis was an ongoing process throughout the collection of data from other sources.

Ethical Considerations

First and foremost, the researcher is responsible for honesty and integrity throughout all phases of the research. Stein and Cutler (2000) specify the researcher's first duty is to conduct research that is scientifically relevant and meaningful, "based on rational, theoretical principles and [carried] out according to a

sound research design" (pp. 34–35). To assure integrity, the researcher took great pains to conduct a thorough review of the theoretical and empirical literature and incorporate that knowledge with her own PBL experience in developing the research questions and design. Additionally, the methods of data collection are varied and based on sound psychometric evaluation as for the *CCTST*, and sound theoretical principles as for the *Self-Evaluations of EBP*, and observations. Multiple methods of data from a variety of sources served to minimize the effect of researcher bias.

Research with human participants requires the researcher to hold fast to three ethical principles: autonomy, beneficence, and justice (Stein & Cutler, 2000). Autonomy refers to each participant's selfdetermination to decide whether or not to participate without duress of pressure, threat, or coercion. Informed consent throughout the research process is essential to assuring participants' autonomy. Participants must be honestly informed of the processes, potential risks and benefits and offered the opportunity to withdraw their participation at any time (Merriam, 1998). To assure students' autonomy, students were given multiple opportunities to withdraw their participation from the research. Students were given two formal opportunities to withdraw their participation; at the outset of the research process, and, if selected for the critical case sample, prior to the interview.

An ethical consideration specific to this study is the possibility that participants may feel inadvertently pressured to participate. Since the observations are conducted on a group level and there exists a strong group culture in PBL programs, students and tutors may feel compelled to participate lest they stand alone in the group. Additionally, even though the researcher removed herself from all

teaching and tutor supervision responsibilities in the occupational therapy program and does not teach or supervise in the physical therapy program, her position as program director may in itself make some participants reluctant to refuse to participate. For this reason, participants will be initially informed of the entire research process and informed again at each phase of the research process before proceeding. Thus, participants were offered opportunities at different points in the data collection to withdraw their participation if they wished. Additionally, individual student's consent to participate in the research was confidential. All students and tutors signed the informed consent and agreed to the researcher's observing the tutorial groups, but students who did not wish to participate were able to not take the pretest and/or posttest of the *CCTST* without the knowledge of their student peers, tutors, or course instructor.

Beneficence refers to the commitment of the researcher to protect the wellbeing of each participant (Stein & Cutler, 2000). The researcher must commit to "do no harm" and to maximize possible benefits to the participants as much as possible throughout the research process. Merriam (1998) reminds us that the qualitative researcher is a "guest" in the private worlds of the participants. As a guest, we have a responsibility to behave in an honest and respectful manner no matter what situation may occur. Throughout interviews, observations and even document analysis, the researcher must stay alert to ethical dilemmas as they emerge. This is particularly important as participants may find themselves saying or doing things they may feel embarrassed about or may not want revealed. Merriam (1998) states that in such situations, hard and fast rules may not be suitable, and the

researcher must be responsible to inform participants when some information must be revealed to protect the safety of all. The researcher worked to guard the wellbeing and privacy of the participants in several ways; first, she maintained the confidence of students and did not reveal students' conversations or interview information that occurred out of the presence of the tutor to either the tutors or course instructors. During the rare occasions when the researcher experienced a strong personal reaction to something that was said or done, she maintained an objective stance and did not comment or visibly react. These situations were always noted in the researcher's comments during inthefield analysis.

The protection of participants' identities is the key issue affecting participants' wellbeing in this research. Since the participants are students who are graded, and tutors, who are evaluated, maintenance of confidentiality is critical. Confidentiality of the participants extends to all phases and levels of the research process, including the dissertation document, the abstract and any future publications or presentations of the research. During the interviews, a few students expressed concern about *confidentiality when they wished to talk about specific persons in their tutorial group.* The researcher reiterated to them at this time that they were free to not discuss names, and if they did, all names were coded into numbers in the transcripts and in the dissertation document to protect the identity and confidentiality of individual persons. The researcher also assured that the content of their interview would not be identified as coming from them.

Confidentiality of participants in this research is taken to the level of the dissertation document as well. Since the occupational and physical therapy programs

are small, it is plausible that the identities of individual tutors and students could be discerned if the name of the University is revealed in the dissertation document; therefore, the University is referred to as the "Faith-based University" including in the text's reference citations.

Justice is the final ethical consideration in research. Justice refers to the equitable distribution of benefits and burdens, as well as to fairness in the selection of the sample and reporting findings. To assure fairness in sample selection the use of specified criteria based on the quantitative analysis of the *CCTST* was used. Bias in favor of or against the occupational or physical therapy program as it entered into the interpretation of the findings was a consideration of fairness in this study. The researcher is the chair of the occupational therapy program and may bias herself favorably toward the occupational therapy students or program. To assure fairness, objective criteria were used to determine if students' critical-thinking and EBP skills improved. Additionally, obtaining the perceptions of the students and facilitators in both programs through interviews, self-evaluations, and behaviorally anchored categorical observations also minimized inequity in the interpretation of findings.

Limitations of the Study

The first potential limitation of this study is with its sample size. This study is limited to students and facilitators in PBL occupational and physical therapy programs in one educational institution. It does not examine the critical thinking or use of evidence-based practices in occupational or physical therapy students in more traditionally designed educational programs or other PBL programs. Therefore, it will remain unknown whether or not students in traditional programs develop critical

thinking and EBP or if those programs use specific instructional strategies to facilitate these skills.

Another limitation of the study's design were the instruments used for the outcome measures. Although a reliable instrument for examining critical thinking was used in this research, the *CCTST*, the instrument's norms include graduates of fouryear colleges and universities with no norms available for graduate students or students in health care education programs. Literally, midway through data collection, the Faciones (Facione & Facione, 2006) published a new instrument measuring critical thinking for graduate, health care education students. Future research or replication of this study would necessitate using the newer instrument, *The Health Sciences Reasoning Test (HSRT)* (Facione & Facione, 2006) as a more appropriate measure of critical thinking for the population included in this study. Additionally, no reliable instrument exists to measure evidence-based practices other than the outline of selfevaluative questions designed by Straus et al. (2005). The self-evaluation questionnaires do offer face validity; however, no other validity or reliability studies have been conducted on the instruments. In addition, in their original form, the items were solely open-ended questions. These were modified by the researcher to include a Likert scale to allow for quantitative data analysis in this research.

It is also not possible to control for a number of variables especially tutor and group process variables. The skill and knowledge each tutor brings to the PBL tutorial process is highly varied, particularly the skills of managing group process, tolerance for uncertainty and "not knowing," critical thinking, use of EBP, and most

of all, their skills in facilitating critical thinking and EBP. Additionally, how each PBL tutorial group works together is highly unique and has been found to affect how the tutor acts in that group. The tutor's skill in managing the group process has been found to be an essential skill, it is not known to be predictive of how the PBL tutorial group will ultimately perform and affect students' learning, critical thinking and EBP skills.

Although the inability to control for these variables is a limitation of this research, these variables tend to be critical factors in determining students' satisfaction with PBL and its outcomes. The research questions in this study specifically explored these variables which presented the researcher with a unique opportunity to identify strategies educators can use that might increase critical thinking and use of EBP in PBL tutorials.

Finally, time was a limiting factor. Data collection occurred over the course of one semester, with the pretest and posttest administration of the *CCTST* and the *Self-Evaluation of EBP* administered approximately 8-weeks apart once permissions were obtained and allowing for exams and vacations. The time lapse between pretests and posttests may have resulted in a learning effect of the *CCTST*. Psychometric information on the *CCTST* did not include information on the potential learning effect for pretests and posttests nor made recommendations regarding an appropriate time period between a pretest and posttest. Facione's (1990c; 1990d; 1990e; 1990f) research to determine the validity of the *CCTST* however, did document the use of pretesting and posttesting with the CCTST within the course of one semester without notable affect.

CHAPTER IV

MAJOR FINDINGS

This chapter presents findings concerning the instructional practices used in PBL tutorial groups and their impact on students' critical thinking and use of *evidence-based practice (EBP). The study specifically examined how the* interactions, expectations, and activities of occupational and physical therapy PBL *tutorial facilitators, students, course instructors, and curriculum design affected the* development and use of critical thinking and EBP in PBL tutorials. Findings are reported through the perspective of the overarching research question: How do PBL instructional practices facilitate the development of critical thinking and EBP?

Subquestions sought to discover if students' critical thinking and use of EBP changed over the course of the semester in PBL tutorials. Specifically the research sought to identify; the changes students made in their critical thinking and EBP; the instructional practices used by tutors and students, the curriculum expectations, and group process variables that influenced students' critical thinking and EBP; and, the specific instructional strategies and practices that may be needed to facilitate critical thinking and EBP.

The data indicated that students made improvements and changes in both their critical thinking and EBP in the PBL tutorial process. The data also exposed the essential elements within tutorial groups that contributed to changes in students'

critical thinking and EBP including group format, quality of the tutor's facilitation, student's disposition and personality, peer and tutor feedback, and the PBL method itself. The data also revealed that contextual factors, primarily curricular design, expectations, and objectives played a defining and critical role in contributing to the development and use of EBP in particular.

The major findings are presented in three sections: The first section describes the changes that students made in the context of PBL tutorials. The findings described are those changes identified by students during the interviews, by the researcher during observations of PBL tutorials over the course of the semester, documented in student-produced tutorial handouts, and changes revealed through analysis of the pretest and posttest data of the *CCTST* and *Self-Evaluation of EBP*. Students identified three major changes: improvements in critical thinking, increased use of evidence-based practices, and greatly improved skill and efficiency in preparing for tutorial. Additional changes included improvements in the ability to recall and use information, and changes in how students participated in the tutorial group process. In describing these changes, students in effect identified the specific tutorial group and instructional practices that they felt contributed to those changes.

The second section is devoted to the presentation of findings regarding the factors in PBL tutorials found to contribute most to students' development of critical thinking and EBP, and thus comprises the heart of this research study. This section highlights that a myriad of factors within PBL tutorials stimulated the development of students' critical thinking and EBP. Emerging as the most significant contributors to improvements in critical thinking and EBP were group format, the tutor's facilitation

skills, the PBL method itself, and feedback from student peers and tutors. Curricular design was revealed to most strongly influence the development and use of EBP. Group processes and interactions and individual personality dispositions also surfaced as important in facilitating improvements in critical thinking and EBP. All of these factors interacted to bring about changes in students' critical thinking and EBP.

The third section focuses on context, especially curriculum design as it influenced the development of EBP in PBL tutorials. In the course of conducting this study, it was found that the most powerful contributor to increased use of EBP were curriculum objectives and course expectations.

These findings make evident that curricular and instructional practices shape *students' development and use of EBP skills throughout the clinical reasoning and* clinical decisionmaking processes during PBL tutorials. This last section calls attention to the fact that, despite the fact that EBP is an objective of PBL; the PBL method in and of itself was found to be insufficient to facilitate EBP. The study's findings revealed that there is a need for specific instructional and pedagogical practices to be integrated across the curriculum to facilitate the development of EBP as part of teaching a system of clinical reasoning. Specifically designed pedagogic practices that are integrated across a program's curriculum have implications for educational leaders. The findings bring to light the importance of a team collaborative approach to curricular design from the bigpicture organization to individual course objectives, expectations, and methods, which integrate specifically designed content and a sequence of skills.

The themes discussed in each section are those that emerged from the analysis of quantitative data from the pretests and posttests of the *CCTST* and *Self-Evaluation of EBP*; questions asked of the critical case sample in 10 interviews; data gathered during ethnographic observations of 18 PBL tutorial groups; and handouts students prepared for PBL tutorials over the course of the second semester of the first year in the graduate occupational and physical therapy programs at the faith-based University. Data analyzed also incorporated key documents including curricular design descriptions, course syllabi, and the OT PBL Tutor Training and the PT Adjunct Faculty Manuals (See Appendices E & F, and, Bortone & Darragh, 2005; [Faith-Based University, Doctor of Physical Therapy, 2005). The major findings *reference field notes and observer comments, observation of PBL tutorials,* documents, quotations from interviews, summaries of pooled responses, quantitative data analysis from the pretest and posttests of the *CCTST* and *Self-Evaluation of EBP*, and data table displays when appropriate.

Changes Students Made in PBL Tutorial Groups

Unexpected Findings

A major finding of this study was that students unanimously felt responsible to their tutorial group for their learning and that the other group members were in turn responsible to them. This finding was universally expressed among the interviewed students and it was a phenomenon about which students expressed strong emotion. While in itself this finding was not surprising, the strong emotions expressed by individual students with regard to their commitment to their tutorial group were

unexpected. The level of commitment they felt also held great meaning for the students. Students articulated a profound feeling of responsibility for their peers' learning. Disappointing their peers by poor preparation or bringing in inaccurate or incomplete information was considered anathema and tantamount to a personal affront to their peers. The emotionally laden language used by the interviewed students in describing their commitment accentuated the level of personal responsibility they experienced with regard to their tutorial group peers.

> So like, if I felt I didn't bring the pertinent information to the group, I was hurting them so on the next test they might not have an answer because I didn't bring the right information. So I felt that everyone should be directed in that I mean even if you don't want to do it for yourself, you're responsible for five other people of the group. That's the last thing I want to do is affect five other people's grade.
>
> You just want to please the other people and not let them down and if they're doing all this work why can't you also just sit down and do it.
>
> I think for me, my personality, I always had the feeling that I never wanted to let anyone down or get them upset. I always think that if I do my part that they can't get mad at me because I have it there.
>
> As soon as you start you realize things that you thought and when maybe someone else doesn't bring back enough information and you realize how that impacts on you, you had to go out to the OSCE [lab practical exam] and didn't have all this information. Me personally, I don't want to do that to anybody else. I don't want to hurt someone. I don't want to impinge on them.

Given the universality of this finding and powerful emotions connected with it, it is surprising that it has been given no attention in either the theoretical or empirical literature on PBL, critical thinking, or EBP. Internalizing a value of mutual responsibility is not a specified goal or instructional practice of PBL, but clearly is a fundamental prerequisite to the success of tutorial groups. Without this mutually endorsed value, tutorial groups do not succeed. Pang et al.'s (2002) developmental

action inquiry research on implementing PBL into a nursing program discovered that students experienced a paradigm shift from valuing teacherdirected learning to valuing cooperative group learning. They also noted that one of the tutorial groups failed due to group process issues (Pang et al., 2002). Although they did not specifically define "cooperative learning" or describe the group process issues that brought about the failure, one can imagine that the unsuccessful tutorial group did not embody a value of cooperative learning or mutual responsibility.

Students attributed the personal and emotional nature of their commitment to their own personalities as well as to the personal peer relationships that developed as a result of the cohort structure of the programs and tutorial groups. The amount of time students spend together on a daily basis rendered the groups "a personal thing" in students' estimation. Students acknowledged forming personal relationships with each other outside tutorial, further solidifying their commitment to each other. They reported frequent "talking online" and "IMing," "instant messaging," each other to "bounce off ideas and reactions" regarding what happened in tutorial and to confirm or refute their perceptions.

Related to mutual responsibility, and equally surprising, were the students' conclusions regarding each other's capabilities and work ethic in tutorial. In the interviews, students openly discussed differences in abilities and learning styles among tutorial group members and expressed willingness to accommodate weaker students. They extended this accommodation to the tutorial facilitator. Students felt that it was reasonable and natural that they and tutors expect different things from different tutorial members in accordance with a student's capabilities:

> It's unrealistic to think that we're all the same. Some of our group members were even struggling to bring the materials weekly. Not from lack of effort, just from difficulties so it's unfair to assume everyone is at the right level cause they're either putting the bar too high for people, or too low, or shortchanging people who are above the bar. I thought [the tutor] was pretty good at catering to people's needs . . . . It's unfair to hold everyone—you should hold everyone to high expectations but to hold everyone to the same expectations is unfair.

Students were observed by the researcher to accommodate and make up for gaps created by students whose abilities and skills were not deemed to be at a high level: The stronger students would routinely fill in information voids left by the weaker students and would prepare their own tutorials to cover the weaker students' topics in addition to their own. Stronger students were also observed to prompt the weaker students by asking questions or explicitly deferring to that student's tutorial topic in an attempt to invite the weaker student to participate.

However, the measure of students' magnanimity toward accommodation was varied and proportional to the perception of that student's adherence to the tutorial group's normative code regarding effort. Students who were perceived as putting in the effort were granted a more generous amount of patience and leniency. However, students who were viewed as not putting in adequate effort were essentially disregarded and isolated by the group or were sanctioned. The following excerpts from student interviews illustrate this finding:

> One specific member never gave their all to the research. So I researched that topic to give it to the group. We were being cheated. The information on the tests came from tutorial. I didn't want my grade to suffer and I didn't want the group to suffer because of one person.

> I would say that everyone put in the amount of effort I would expect. Uhm, like, there were times that people didn't get the right information and the group definitely suffered from it. But it wasn't from lack of trying. I feel that everyone put in an appropriate amount of time, whether they were successful

> or not is a different issue. But the fact that they put in the effort does mean a lot like work. [We would say] In peer evals, like "It really looks like you put a lot of effort into it." If it wasn't successful, it would be like this, "Look, you *did a great job on this; it just wasn't what we were looking for.*" There was never a lack of effort. Someone didn't come in with a half a page and say, "This is all I could find," that wasn't an issue. That might have cropped up once and there was high feedback on, "You really need to do more work, you really need—you are not consistent, sometimes you are four pages sometimes a page and a half—what's going on with that?" The one time it really was an issue, the group really communicated in the peer eval in the midterm and final evaluation.

Other students were observed to express impatience toward students who habitually came to tutorial with missing or inaccurate information, insisting that the student find the missing or inadequate information on the spot lest the group experience the extra burden of having to do additional preparation to accommodate for students perceived to be weaker. The following exchange from a tutorial observation and passage from a student interview affords a view of both accommodation and impatience in dealing with the inequity:

> Tutor: [To student #10] You don't have it clear. Is one leading to another? Is it unto itself or a progression?
> Student #10: One evokes the other
> Tutor: I don't know if that's the case.
> Student #3: The flexor comes first
> Tutor: You need to find out.
> Student #8: [looks at a book]
> Student #6: [looks at her laptop]
> Student #3: [With a sharp tone of voice] Why doesn't student #10 look it up since it was her topic?
> Student #10: But it's not in the book
> Student #3: [To student #10] No on the laptop. Use student #6's laptop to look it up.

> *I got very frustrated with two of the members in particular uhm.* Am I allowed to use names? Students # 25 and #26 are two people I thought put a tremendous amount of effort into it, perhaps more so than me, hours' wise. But especially student # 25 it didn't translate, you would become—I got very frustrated especially if #25 would take a bigger topic. #25 would have a big

topic I knew would be on the quiz, I would do the work myself. I would make sure I read #25's chapters thoroughly.

Individual character disposition also played a pivotal role in providing the energy for growth and change among the group that constituted the critical case sample. Students bring their own personality and disposition to the program and tutorial process, since these are established prior to entering an academic program. Preexisting characteristics students identified as contributing to the changes they made in their critical thinking and/or EBP included self-directedness, curiosity to "always look things up," setting a goal to change their usual role in tutorial, being organized, and hard work. This finding gives credence to Facione's (1990a) hypothesis that critical thinking requires a prerequisite disposition that is innately curious, openminded, flexible, honest in facing one's knowledge, skill, and attitudinal shortcomings, and conscientious in seeking pertinent information. It also has implications for the type of admission criteria and procedures established by educational leaders of PBL programs.

Finally, the practice of reflection appeared to be a primary motivator in impelling students to link inquiry to practice when preparing for and participating in tutorial. Students reported first developing, then engaging in a continual process of critical self-questioning concerning the criteria by which they made judgments, how they framed the clinical problem and question, and how they could apply the information and research they found to the tutorial case in an attempt to "try to make sense of it" (Schön, 1983, p. 50). Self-reflection spanned critical examination of information to critical examination of one's own skills and participation in tutorial. The following are examples of students' reflective thinking:

> I think it's the change in thought process like when I look at something; I look at, "What is this asking me? What do I need to do to really answer the question? Why are they asking me the question in the way they are asking me the question? What, how are they expecting me to come to that conclusion?" It's just the way of really viewing what it is asking of me.
>
> When you break down a case and you figure out what you need to know and you think about why you are choosing one over another and was one more particularly important or not.
>
> There are times where it [the program] makes you do a critical analysis of yourself and you have to be able to sit back and take criticism and you have to be able to look at your own strengths and weaknesses. I was able to sit back and look at what I was doing and what was (sic) my strengths and weaknesses.

These examples embody the essence of reflective practice as articulated by Schön (1983) and Facione (1990a). Reflection, indeed, seemed to be a prerequisite for the development and progress in both critical thinking and EBP. Students used the practice of reflection to drive themselves to higher levels of critical thinking and EBP. Self-reflection was the key that unlocked the door to change, moving to higher levels of critical thinking, changing one's role in tutorial, and applying research evidence to the clinical case in PBL.

Changes in Students' Critical Thinking and Evidence-Based Practices

The study sought first to answer the primary question underpinning the research: Do PBL instructional practices facilitate critical thinking and evidence-based practices (EBP) in students? To answer this question, the researcher utilized two quantitative measures: the *CCTST* and the *Self-Evaluation of EBP*. The researcher administered a pretest and posttest of the *CCTST* and the *Self-Evaluation of EBP* to measure changes in students' critical thinking skills and perception of the extent to which they used evidence-based practices.

The answer to this question appears to be that students' critical-thinking skills and EBP did improve over the course of the semester in PBL tutorials. An effect size was chosen to analyze the quantitative data. Effect size is a statistical indicator that measures the extent of the intervention result independent of sample size (Cohen, 1988; Thalheimer & Cook, 2002). Cohen's *d* was used to calculate effect size. Cohen's *d* was obtained by calculating the difference between the pretest and posttest means divided by the composite standard deviation. Cohen's *d* yields an effect size with a standardized interpretation ranging from a small effect (≥ 0.15 and < 0.40); a medium effect (≥ 0.40 and < 0.75); or, a large effect (≥ 0.75 and < 1.10) (Cohen, 1988; Thalheimer & Cook, 2002).

Given the study's conditions of a small sample size, the short period of time between the pretest and posttests, and the fact that the research question sought to determine the effect PBL tutorials had on students' development of critical thinking and EBP, Cohen's *d* effect size was deemed an appropriate statistical choice. Cohen's *d* is also a preferred statistic for repeated measures and for quantifying effects measured on unfamiliar scales as is the *Self-Evaluation of EBP* (Glass, McGaw, & Smith, 1981). Moreover there is a clear precedence for using effect size statistics in PBL research. Effect size is found in the metaanalyses of PBL outcome research cited in Chapter II of this document. (See for example, Albanese, 2000; Bloom, 1984; Colliver, 2000; Newman, 2003; Norman, 2002). Effect size is used in metaanalyses because it can be calculated from descriptive statistics included in individual studies despite the fact that each study used different statistical analyses.

Context is essential in the interpretation of effect size as the significance of the effect must be interpreted in light of cost to benefit analysis. In education and health care, a small effect size of d=0.1 can be considered a highly significant improvement particularly if the effect is applied to all students or patients, if the gains result in a cost savings, or an improved quality of life (Glass et al., 1981).

With regard to the effect of problembased learning, there has been considerable discussion in the literature as to what effect size should be considered significant enough to warrant converting a less expensive, traditional, lecturebased health care education program to a more expensive, problembased learning model (see for example, Albanese, 2000; Bloom, 1984; Colliver, 2000; Newman, 2003; Norman, 2002). Each author of the various PBL metaanalyses considers a different threshold of effect size significance in their interpretation and discussion. Albanese (2000), for example, determined that the PBL group would have to move from the bottom 25th percentile to the top 25th percentile of the class in order to demonstrate a large effect of d=0.81.0 and therefore concluded that a small effect of d=0.2 is all that is needed to consider PBL an effective method of teaching and learning. Norman (2002), Bloom (1984) and Newman (2003) concur with his conclusion. However, Colliver (2000) believes that a large effect size of d=1.0 should be the minimum effect size expected in order to justify the increased cost of instituting a major curriculum change such as PBL. The metaanalyses of PBL research establish a clear precedence for using the effect size calculation to determine the significance of change in PBL outcomes, therefore, the effect size calculation was chosen for use in the analysis of quantitative data in this study.

Effect sizes were calculated for the OT group, the PT group, and the pooled group of students. Effect sizes indicated improvement in both critical thinking and EBP. From the pretest to posttest of the *CCTST*, the OT group demonstrated a medium effect of d=0.64; the PT group demonstrated a small effect of d=0.19; and the pooled group demonstrated a smallmedium effect of d=0.32. From the preto posttest of the *Self-Evaluation of EBP*, the OT group demonstrated a large effect of d=0.85; the PT group a smallmedium effect of d=0.39; and, the pooled group a medium effect of d=0.57. These data can be seen below in Table 1.

Table 1

Group CCTST and EBP Means, Standard Deviations, and Effect Sizes

Group		PreCCTST	PostCCTST	PreEBP	PostEBP
OT	n	12	12	11	10
	mean	17	19.33	127.55	139.6
	s.d.	3.22	4.31	15.44	14.18
	effect size	0.64**		0.85***	
PT	n	18	17	18	11
	mean	20.44	21.29	110.06	117.81
	s.d.	4.16	4.97	18.09	24.12
	effect size	0.19*		0.39*	
Pooled	N	30	29	29	21
	mean	19.17	20.48	116.69	128.19
	s.d	4.13	4.73	18.93	22.48
	effect size	0.32*		0.57**	

*small effect (≥0.15 and <0.40)

**medium effect (≥0.40 and <0.75)

***large effect (≥0.75 and <1.10)

An additional effect size calculation, Pearson's *r* Correlation, was utilized to calculate the size of the change from pretests to posttests of the *CCTST* and the *Self-Evaluation of EBP* in the pooled group of students. Pearson's *r* correlation for the *CCTST* posttest was .79** significant at the 0.01 level. Pearson's *r*=.79 squared

revealed that 62% of the variability in the postest of the *CCTST* was predicted by the pretest. Therefore, the improved critical-thinking scores of only 38% of the sample were unexplained by the pretest of the CCTST and open to the effect of other variables including PBL. Given the fact that the participants are graduate students and that critical thinking is a universal skill expected of college students, it is likely that students entered the OT and PT programs with substantial critical-thinking skills already in place and therefore may have been less susceptible to the effect of an educational program. Additionally, the *CCTST* is designed for four year college graduates not for graduate students and the instrument may not have been refined enough to accurately measure participants' critical thinking. It would be interesting to replicate this study using the newly published *Health Sciences Reasoning Test HSRT* (Facione & Facione, 2006) which was developed for graduate health science students to determine if the pretest *HSRT* is as predictive of the posttest as when the *CCTST* was used as a measure for changes in critical thinking.

The significance of the pretest and posttest of the *Self-Evaluation of EBP* was .57. This number squared indicates that only 33% of the variability of the posttest could be predicted by the pretest leaving 67% open to the effect of PBL and other variables. It was not surprising to this researcher that the pretest of the *EBP* was less predictive of posttest scores on this measure. Evidence-based practice is a skill new to students when they enter the occupational and physical therapy programs and it is unlikely that the participants would have entered the pretest with significant skills in EBP. These data are shown in Table 2.

Table 2

Pearson's r Correlations: PreCCTST, PostCCTST, PreEBP, PostEBP

		Pre CCTST	Post CCTST	Pre EBP	Post EBP
Pre CCTST	Pearson Correlation	1	.79**	–0.32	–0.53
	Sig. (2tailed)		0	0.09	0.01
	N	30	29	29	21
Post CCTST	Pearson Correlation	.79**	1	–0.32	–0.37
	Sig. (2tailed)	0		0.08	0.11
	N	29	29	29	21
Pre EBP	Pearson Correlation	0.32	0.32	1	.57**
	Sig. (2tailed)	0.09	0.08		0
	N	29	28	29	21
Post EBP	Pearson Correlation	–0.532	–0.37	.57**	1
	Sig. (2tailed)	0.01	0.11	0.01	
	N	21	20	21	21

** Correlation is significant at the 0.01 level (2tailed)

* Correlation is significant at the 0.05 level (2tailed)

Changes in Critical Thinking

Data collected from student interviews and ethnographic observations confirmed the theme that students experienced a change in themselves over the course of the second semester in PBL tutorials. Most of the interviewed students experienced a major change, almost an epiphany, in their critical thinking. They discussed in detail the transformation they made in their thinking and ability to question information. Students reported that they no longer accepted at face value, information presented in text books, lectures, or even empirical research. They found themselves asking more critical questions of the material they were reading, asking themselves about what made a particular source credible, and asking themselves how it applied to the case. The energy, excitement, and happiness students expressed about this change in themselves was unexpected as was the fact that some students reported that the change extended beyond school into their personal lives.

> Something happened to me this semester! Something clicked this semester. I do this because of this. I don't know what [changed] really, but it did and I'm happy. I do that [question things] all the time now with anything. I don't know what it was. I'm excited about it though!

> I see a change in myself, I didn't think this way before. The kind of thinking I have now, I don't think I would just normally think like that! And I can see progress in myself. From the time I started the program to the time I did the second questionnaire and maybe to now. I definitely see a big change.

> When you're going through high school and even undergrad to a certain extent, it's just a matter of like you're churning out work, so when someone starts asking you to think...because before you just assume that I read this in the books so it must be right—they must be right. And then when you ask yourself, and when you actually stop and think about it.

> By this semester the expectations of yourself are higher. Your expectations of each other are higher. You want to critically challenge. You want people to challenge you cause you want to say why you got what you did.

> For studying for tests, I would do like a tutorial—I would read on each topic. The first semester was more memorization. There is more critical thinking this semester.
>
> I started to ask more integrative questions. "How does this relate to this?" The different topics each person had, in my preparation for tutorial I began to think how mine related to others and to PT.

Changes in Evidence-Based Practice

Changes in evidence-based practices (EBP) to some extent divided along lines of the OT and PT tutorial groups whereas changes in critical thinking were more common across the two groups. The group of OT students consistently used and referenced evidence-based research in tutorial, whereas, the PT students as a group did not. The research revealed that curricular expectations and not other factors including tutor facilitation was the element that contributed to the difference. The OT curricular expectations as documented in the OT PBL Tutor Training Manual and course syllabus mandated students to bring in a minimum of one critically appraised topic (CAT) on a research article for each tutorial that relates to their particular topic. The CAT, is a specifically formatted summary of a published empirical research study. The OT students were required to search peer reviewed journals and report on an empirical research study that related to their tutorial topic each and every tutorial. The PT students on the other hand, were not mandated as part of their tutorial course to include empirical, evidence-based research in preparing for tutorial. Rather, the PT students expanded their use of EBP in one of the supportive research courses that they took simultaneously with the tutorial course (See Appendix E for the PT Course Syllabus). The impact curricular expectations had on the development and use of EBP is discussed in detail in the third section of this chapter.

The sole exception to this finding was in PT tutorial group two where the tutor gave individualized feedback challenging select students to begin to use research evidence in tutorial. Those students showed evidence during the researcher's observations, which was substantiated their handouts, that they used and referenced research evidence in support of their tutorial topic. One of these students described how this occurred:

> *My tutor said "[my name], you bring great material to it [tutorial] you really* use textbooks, resources everything. What I'd like for you to take the next step is to use more evidence-based things." So the way I would see that not being consistent amongst everyone is I'm probably at a little bit of a higher level than some of the other group members as far as some of them are struggling to just get the content, whereas I can just take the next step and look at more evidence-based. I don't think [the tutor] wanted to necessarily to overload other people...it would be like, "You're not finding material you need in the text book go look in a research article." One of the biggest changes I did make this semester is that I used evidence-based a lot more. When some members used evidence that really kind of— "whoa"— your ears would perk up! It was interesting. It piqued my interest more. It was interesting. Reading a text book is not nearly as interesting as reading a *clinical trial. The text gives you the information a little bit more raw and the* research more in the clinical setting. So I think that enhanced everyone's interest and also comprehension. Because you can see the relevance of it.

Both the OT and PT tutors gave their lowest selfrankings on the three subsections of the *Self-Evaluation of EBP* that addressed searching for, critically appraising, and modeling the integration of research evidence with the clinical case: selfratings on these subsections ranged from a score of one—"rarely, about 25% of the time" to a maximum of four—"some of the time, 60%75% of the time" out of a possible score of seven. Statistical analyses were impossible to calculate due to the extremely small sample size (six tutors) combined with missing data on the *Self-Evaluation of EBP*. Two facilitators did not complete the posttest of the *Self-Evaluation of EBP*, two did not complete some of the three EBP subsections, and one

facilitator did not complete several individual items in the pretest and or posttest of *Self-Evaluation of EBP.*

Analysis of the quantitative data from the pretest and posttest of the *Self-Evaluation of EBP* revealed that the OT group made greater gains in their EBP than did the PT group. Effect sizes of the OT group indicated a large effect size change of d=0.85 whereas the PT group made a smallmedium effect size change of d=0.39, substantiating that changes students perceived in their use of EBP changed more significantly in the OT group than in the PT group (See Table 1. *Group CCTST and EBP Means, Standard Deviations, and Effect Sizes*). Even though the OT group made greater changes in their effect sizes, the change in EBP in both groups can be considered significant given the short time lapse between the pretest and posttests, the number of students in which there was a change, and the meaning of the change itself. Since EBP is a core objective of all health care education programs, any change in this skill can be considered significant.

Analysis of student produced handouts, observations of PBL tutorials, and the *Self-Evaluation of EBP* corroborates the finding that the OT students made greater changes in the use of EBP than did the PT group. During PBL tutorials, the OT students consistently discussed information obtained from organizational web sites, text books, and research articles from peer reviewed journals. Review of the OT student handouts revealed that all the students routinely cited a minimum of four references that included at least one reference to an empirical research study published in a peer reviewed journal. The OT handouts also included at least one critically appraised topic (CAT) summary in its text. PT student handouts

consistently cited a similar number of references but these were obtained from a wider variety of text books, course instructor's lecture notes, and web sites. Even though PT tutorial course syllabus did not specifically mandate the use of research evidence in tutorial, on multiple occasions the researcher observed tutors pressing students to reference research articles from peer reviewed journals when preparing for tutorial. The tutors' approach appeared to have little to no observable effect on students' use EBP in tutorial or on the tutorial handouts.

An additional finding was that some students noticed a difference in how they approached using research evidence when preparing for PBL tutorial. As the semester progressed, and they became more familiar and comfortable with reading and understanding clinical research articles, some students began to look at the research first, before going to text books, because they found that the research was more relevant to expanding their understanding of the clinical case:

> By the end—[of the first semester] I would do all my research then look up research articles and do my CATs [critically appraised topic] last. By the end [of the second semester] I did it first. In the introductions of the research, they are always talking a lot about the topic and I could always get a lot of information. That is something I didn't do at the beginning. At first I did it at the end. By the end of the [second] semester I did the opposite. I looked at the research articles and did my CATs at the beginning of researching my topic. I got more ideas out of reading the research first. I realized that when I was reading the articles, "Oh, this would have helped me three hours ago." And articles always have more articles that they go to so that is also a way to get more information.

These students began to not only seek out research evidence that was relevant to their topic, but also to think more critically about the evidence in terms of what it might mean to clinical practice and their PBL case.

Increased Efficiency and Effectiveness in Conducting Research

The experience of greatly improved efficiency and effectiveness in preparing for tutorial, researching information, and mastering technology emerged as a major finding of the study. Students universally reported that the time spent preparing for tutorial decreased from "days to a couple of hours" and that the quality of material they were getting was better. Students cited learning how to use key words, Booleans, and other strategies to narrow their searches, as methods that greatly improved the quality of material they were getting when preparing for tutorial. Learning their way around the library research data bases was also mentioned as extremely important in increasing efficiency.

> I think that my biggest thing was learning how to do the research and that was a stumbling block in the beginning but once you get the hang of it you know where the journals are, what you're looking for, how to do your research.

Familiarity with the professions' terminology was also noted to help narrow search terms. As one student articulated, "You can have a few hits and suddenly you change a word and you get more. Part of it is knowing the terminology—knowing the lingo."

Changes in Retention and Recall of Information

Learning, understanding, recollection of content continued to reveal itself to be an important objective for students. A few of the interviewed students experienced a change in how much they remembered information. They noted that their knowledge was more easily retained and that even when they were out of the school context, they actually learned and found themselves able to answer questions posed

by persons outside the academic program. "Looking back" became an important tool in realizing what one had learned.

> Now I read. Now it all stays in there. Before I read and it wouldn't stick. At the middle of the semester when I did tutorial, I would remember everything I did. Something happened midsemester.

> When someone not in OT asks you something and you're able to just answer—it's really cool, I learned it! But when you're in it, there are all the relationships and you're seeing people everyday you don't realize how much you're learning. You're all caught up.

Factors that Contributed to Critical Thinking and EBP

The study uncovered several factors that influenced students' ability to develop critical thinking and EBP. Strongest among the factors that influenced the development of both evidence-based practices and critical thinking were the tutorial group format, the tutor's facilitation, peer and tutor feedback, and the PBL method itself. Curricular design and expectations emerged as the major contributor to the development of EBP.

It is noteworthy that 70% of the students meeting the criteria for the critical case sample came out of 50% of the tutorial groups; PT groups one and two and OT group five. Four of the five PT students who made the greatest improvements in their *CCTST* and *Self-Evaluation in EBP* scores emerged from PT tutorial groups one and two, with the fifth coming from PT group three. No students in PT tutorial group four met the selection criteria. Among the OT students who met the selection criteria for the critical case sample, three of the five students came from OT group five and the other two from OT group six. This gives credibility to the idea that there might be something unique about what goes on in the tutorial groups that produced greater

numbers of students who made improvements in their critical thinking and EBP; and, that those unique characteristics more significantly affect the development of critical thinking and EBP.

The researcher experienced the tutorials that produced greater numbers of students who met the criteria for the critical case sample as exciting and observed a palpable level of collaboration, mutual responsibility, and commitment to the group among students. Students and tutors in these groups clearly supported one another, consistently knew when a member was going to be late or absent, questioned each other, laughed, and joked with each other. In contrast, the researcher experienced the other tutorial groups as less appealing and more arduous. Observation transcripts also revealed that studenttostudent interactions in these tutorials were significantly fewer in number. Moreover, group format and the nature of the tutor's facilitation were also markedly different in the tutorial groups that produced larger numbers of students meeting selection criteria for the critical case sample than they were in the other tutorial groups. The differences are discussed in detail in the group format section that follows.

Group Format

Transition from RoundRobin to Discussion Format

The group format, the nature of the tutor's facilitation, and the PBL method were overwhelmingly cited by the students who were interviewed as the practices that affected their critical thinking most profoundly. Students in PT tutorial groups one and two and OT tutorial group five that produced 70% of the critical case sample

reported that their groups changed format; transitioning from the roundrobin reportingout format they used first semester, to a discussion format. Students acknowledged the format change had a very significant impact on the development of their own critical thinking, critical analysis, and in some cases, leadership in the group. The majority of students' interview comments celebrated the advantages of the discussion format.

In the traditional roundrobin format all the tutorial groups used first semester, students would take turns reporting the information they had found on their respective topics. Students experienced this as "boring" stating that they frequently "zoned out," "retained little," and tended not to question each other even when they didn't understand the material being presented. Students repeatedly made such comments as: "Sometimes, to be honest, I would zone out because that's what you do during a report out." And, "When people are reporting out, people are daydreaming and not really listening." Students likened reporting out to "student lectures," admitting that sometimes they read information to their tutorial group without a true understanding of what they were reading. As one student aptly put it, "I would just present it. I would wait for people to ask me to explain it—ask me questions. Sometimes I wasn't always ready to answer them."

In all cases, students stated that although the change to the discussion format was suggested by the tutor it was a "group decision" to change the format. This apparent contradiction is borne out by the researcher's observations. PT tutorial groups one and two and OT tutorial group five routinely operated in a group discussion format, whereas the remaining three continued the roundrobin with only

periodic discussion. Despite the fact that the tutors of the three roundrobin formatted tutorials repeatedly encouraged the group to change to a discussion format, and suggested strategies to do so, the groups did not successfully make the transition. PT tutorial group four articulated their resistance to the change and attributed it to an unsuccessful attempt at one of these strategies.

It is salient to note that each of the three groups that successfully transitioned to a group discussion format used different structures and strategies to do so. Deeper analysis of the data exposed three unique characteristics common among the three discussion formatted groups that contributed to the successful transition: (a), tutors and students were observed collaborating together to develop a structure to facilitate the transition. The collaboration was comprehensive in that it included a dynamic evaluation by students and the tutor to assess the success or failure of the strategies they tried and subsequent suggestion of another strategy; (b), the researcher observed that the level of personal commitment and mutual responsibility to peers and to the tutorial was markedly different in the three discussion groups. The mutual commitment students had to each other in these groups was obvious to an outside observer; and, (c), the amount of discussion and interaction in these groups was noticeably greater. The literal numbers of student to student and tutor to student interactions as documented in the observation transcripts of the discussion formatted groups were considerably greater than in the roundrobin formatted groups: Discussion formatted group transcripts were markedly longer with each individual's contribution shorter but more numerous. They also included more questions.

Collaboration in Selecting a Structure to Transition to Discussion. Tutors suggested moving to a more integrative discussion format guided by the case. Although students went along with the suggestion, in most cases it was initially greeted with trepidation and the groups underwent a period of awkward adjustment. Students felt that they "weren't very good at it at first" and "not very eloquent" executing the transition to a group discussion. They also had to wrestle with previously valued social norms such as "politeness," not "interrupting" and "allowing someone to finish," and, breaking away from the habitual way of doing tutorial. Students from both the OT and PT groups use the metaphoric description "jumping in," which aptly describes the individual effort required to overcome accepted social norms in order to engage in discussion.

Each group that was successful at transitioning to the discussion format developed its own unique strategy to do so. These strategies materialized from collaborative discussions between students and tutors along with some trial and error. In all cases, the strategies were clearly negotiated, articulated and agreed upon by the tutorial group. More than one of the three groups tried and failed at first to transition to a discussion, but then proceeded to evaluate the success and failure of the attempt, and moved on to select another alternative. One student describes her group's process:

> The first time [the tutor] wasn't there but we had decided we wanted to try it [a discussion format], so we did it completely wrong. We had a sheet of paper and we all just summarized our stuff on the paper. People would report out and someone would write things down. So we just looked at each other's stuff. When [the tutor] came back, we liked that it was a discussion, it went quicker and we got more out of it. But she said that, 'It wasn't really what I had in mind.' We started then with just one person reporting out. Usually

> *start with the diagnosis, when that person is talking—we just kind of jumped* in.

PT group one decided to begin tutorial by reading the case with each student "jumping in" when their researched topic was relevant to that point in the case. A student describes the process and credits the tutor with assisting the group:

> We would read the case; one of us would step in when necessary. The set up is you have to address others' topics. A lot of time in the beginning we just went around the circle. [The tutor] helped us tie things together.

PT group two also began with reading the case but began discussion around the condition in the case and worked backward, moving from the foundational sciences forward to clinical application. In the following student's opinion, this had the effect of increasing dialogue as well as integration of the material:

> [The tutor] had the idea of, "Why don't we go through the case?" That was interesting because that changed it from the anatomy being first to often the diagnosis being first. That turned it upside down cause instead of leading with the anatomy and having everyone else interject, you lead with the diagnosis. Person first. Diagnosis; this is the anatomy you need to know to understand, so it turned things over. It lends itself more for integration so I would recommend it. Also people saw the connections more clearly. Whereas in other tutorials, people have the information but they don't see how it fits. It's *not that they don't want to jump in, they just don't know the connection.* [We did this by] asking openended questions, trying to tie in, people trying to get people with similar topics to have a conversation like maybe someone with the person with diagnosis, the person with treatment, the person with tests and measures, they shouldn't take turns. They should be like "This is the diagnosis," "This is how to test for it," "This is how to alleviate some of the symptoms of it."

Two students in this group (both meeting criteria for the critical case sample) actively assumed leadership and facilitated peers by questioning them, inviting others into discussion, challenging information as to its accuracy, credibility, and clinical application, and organizing the group's work. Student facilitation and leadership seemed to be a potent force in the development of this group's strong sense of

commitment, mutual respect, and mutual responsibility. This was also the only group that consistently ran well over the three hours designated for tutorial without one complaint by any of the students. This group met a half hour before the tutorial began and before the tutor arrived to complete the case break down phase of the tutorial. Once the tutor was in attendance, the tutor would review the group's progress and further facilitate the case breakdown.

The third group, OT group five, used concept maps and began discussions around the hypotheses they had established the previous tutorial. The students discussed evidence and information they found to confirm or refute the hypothesis or develop a new hypothesis:

> Each person wrote down on the concept map just key points that would initiate other people to ask questions, so we would read through each of the columns we made and have people ask questions to verify the information and to explain it further...*One person would look it [the topic] up but we just tried* to put it all together so we're not all reading off our handouts. Just get to the main points, bounce off each other and using everybody in the group. And trying to link it all together because there's obvious linkages—that's the reason why we are doing all the topics we are doing. There were also times when there were people who spoke and knew what other people's topics were. So they would ask, "So didn't you have such and such?" That worked also and usually they did.

Debate was an additional strategy used by this group. During the case break down phase, students would decide to research a topic together and then "compare." Debate effectively deepened students' understanding and facilitated more critical thinking and critical challenges of each other's information:

> There would be more to talk about. More to debate. The more information there was, the more you had to challenge one another with. Somebody would find the opposite of what you just said. If we had just touched on the surface of everything, we would not have gotten to stuff we are probably going to see when we are out practicing...I just remember two of us had research articles that said the exact opposite of one another's. It wasn't like you're pitted

> against each other. It was more like discussing, "Why could mine be right and mine be wrong?" And, "Why could yours be right?" We decided to do it that way.

The PT group four that attributed its discussion transition failure to an unsuccessful attempt had tried, at the tutor's suggestion, to rotate the role of facilitator amongst students. A student was designated as "student facilitator" who was responsible for facilitating his and her peers by asking "integrative questions." This last strategy was not observed to be effective in facilitating discussion. During the researcher's observations, it was impossible to glean from members' behaviors the identity of the designated student facilitator. The researcher did observe, that when it was a student's "turn" to assume the role of facilitator, students frequently begged off assuming the role, asking to "switch turns" with another student.

In contrast, in the discussion-formatted groups, students who assumed a facilitatory role tended to be selfselected or informally but definitively chosen by their peers to assume this role. These students were perceived as knowledgeable and advanced as indicated by their command of the foundational information, use of evidence, and ability to connect one factor of the case to another, and then connect it to the clinical case. Student facilitators assumed a more active leadership role and worked hard to facilitate their peers through questioning, bringing quieter students into the discussion, and pointing out when and where someone should "jump in" with their information on the topic.

Mutual Commitment and Responsibility. In all of the discussion-formatted groups, members were observed to be highly supportive of one another, openly encouraged one another to participate, acknowledged a job well done, and appeared

to be more personally involved with one another. For example, when a member was absent, that student never failed to inform at least one other member about their absence and frequently supplied the tutorial group with his or her handout in advance. Although mutual support was present in the round-robin-formatted groups, it was although less consistently observed.

While commitment and mutual responsibility were not expressly identified by students as contributing to the discussion format, it was the absence of these things in the tutorial groups that continued the roundrobin format that the researcher noticed during observations. The three groups that did not successfully make the transition to the discussion format were distinguished for their general lack of energy, occasional absence of warmth, and sometimes tension. The researcher observed several instances that exemplified lack of commitment to both the tutorial and to each other as persons: On one occasion, the tutor in PT group three asked a student if they were familiar with the specific condition under discussion. The student revealed that her father had died of that condition. There was a complete lack of response to the student on a human level from the tutor or other students. The researcher wondered at that point what the potential impact this lack of a caring human response might have on the group. On another occasion, a member's absence from that same tutorial group was not communicated to either the tutor or peers, leaving a vacuum in the discussion that contributed to an undercurrent of anger in the group. OT group six was rife with tension centering around one member's habitual lack of adequate information. This group demonstrated frustration nonverbally through rolling eyes and heavy sighing. Sometimes the group appeared to freeze in silence rather than

confront the issue. The group members would not question the student, rather acted as if she was not present. While waiting for the tutor to arrive, PT group four repeatedly engaged in conversation discussing ways to end tutorial early, schedule food breaks, and suggest that the group meet in a more social setting outside the University. This was also the group where members were reluctant to assume the role of facilitator.

Increased Discussion and Interactions. Students in the groups that successfully transitioned to the discussion format underwent an increase in the amount of interaction within their tutorial groups. Observation transcripts validated the increased interaction, particularly studenttostudent interactions. It was also observed that each student's contribution was shorter in length as students' "lectures" evolved into shorter segments punctuated by questions that they would pose to the group or that the group would pose to them. Students in these groups struggled to work out unclear information, absence of information, and conflicting information amongst themselves without the explicit correction or direction from the tutor. Rather, tutors in these groups, would encourage the group to "struggle" and "work it out" themselves, giving hints to scaffold gaps and confirm right direction.

Increased discussion and interaction was experienced favorably by the students. An increase in attentiveness, learning, and interest was reported in the discussion groups. A sense of collaboration developed as students felt that they "were in this together." Students also felt their own individual participation and comfort level increased as they were no longer "on the spot" with all eyes on them, and that an atmosphere of freedom to make mistakes developed. Individually,

students reported that if they could not find some information or did not understand something that it was likely that the group would help them out or that someone else would illuminate the issue.

Advantages to the Discussion Format: Effect on Critical Thinking

Students cited clear advantages to the discussion format as it effected critical thinking in particular. Students reported that the change to a discussion format allowed all the students in the tutorial to facilitate one another; students were aware of one another's topics and would actively invite the participation of quieter members into the discussion, would ask one another more questions, and would critically challenge one another's information and sources.

Students identified the transition in format to a discussion as one of the factors that most powerfully impacted critical thinking. They noted greater ability to integrate the material and ability to connect their topic with what others presented. Students had a great deal to say about the advances they were able to make in their own critical thinking as a result of the change in format:

> You have to be part of the discussion no matter what the topic so you got more out of it, which is good. You could see how other people's information is related to yours. If it supported what you found or not.
>
> The way we went about it changed—we had to integrate.
>
> I think that knowing the key points helps you generate questions in our mind. OK, that's a key point, why is it that a key point? You start questioning why you think that was important, why you think it was brought back to the discussion.
>
> I just started asking more questions and began to critically analyze my peer's information more. Ask questions. "How was that relevant?"

> PBL was more of a discussion rather that strictly reporting out. And I felt that helped me understand and more critically think about different aspects about what was going on in the case.
>
> It was more like questions were asked when you were supposed to be asked.
>
> I feel like if I don't understand the material now, I am more apt to ask the questions than previously, when we were just reporting out.

Tutor Facilitation

The way in which tutors facilitated the tutorial groups emerged as the most significant practice that shaped and contributed to the development of students' critical thinking and critical analysis. Tutors' facilitation was cited by the interviewed students as crucial to facilitating changes in critical thinking and EBP. First and foremost, the tutor was viewed as setting the tone of the tutorial by creating an atmosphere for learning. Key to this was an atmosphere where students felt free to make mistakes, question and give feedback to the tutor, and were constantly challenged. Students identified the skilled tutor as one who managed the "fine line" between silence in which students were left to struggle to figure things out on their own, and intervening with information or direction. Students expressed humor and pride regarding situations where they felt that their feedback was instrumental in facilitating the tutor's learning how to negotiate this line.

Tutors' Constant Questioning—Challenging

Students identified the type of questions the tutor posed to the group and allowing the group to struggle with those questions as essential to increasing their own critical thinking. Students reported that the tutors asked, "Why?" a lot and "just kept asking and pushing." The constant questioning, challenging, pushing, and

allowing the group to struggle emerged as vital to facilitating group's collaborative problemsolving and critical thinking.

Students lauded tutors who constantly asked questions about research, asked students to identify why particular information was pertinent, asked the group to look up even small but relevant pieces of missing information, and challenged students to constantly "think deeper" to "come up with a different hypothesis about why you believe that would be true" instead of settling for the obvious. The researcher's observations of PBL tutorials confirmed that the tutors of the discussion groups intervened twice as often as the tutors of the groups that did not successfully transition to the discussion format. The majority of questions posed by the more successful discussion group tutors consisted of "What else?" "Is that [the missing information] important for us [OT or PT] to know?" And, "How does that relate to the case?"

Key to the questioning process was the tutors' comfort with silence and ability to allow the students to struggle with answering the questions without jumping in. Students identified the tutors' allowing them to struggle and to resist giving information as helping the group as much as the questioning itself. The following exchange between students and the tutor is an example where student #27, as part of his tutorial, posed a question to the group. This illustrates how the tutor, instead of directly intervening, encouraged student #27 to allow the group to struggle and come up with the answer to the question on their own:

> Student #27: Where would the plaque be located if she [the patient in the case] has nystagmus?
> Student #18: [Begins guessing incorrectly]
> Student #27: Is it in the white matter or grey?

Student #18: White.
Student #27: So it wouldn't be a nucleus. Think about other patients we saw with nystagmus.
Tutor: [To student #27] Let them work it out!
Student #18: C.N. 8?
Student #27: There are 2 areas—
Student #18: It's dorsal—[trails off]
Student #27: The other one—what's around the vestibular nuclei? What links each thing together?
Group: Silent
Tutor: [To student #27] No—make them look it up! [To the group] I have the Haines text.
Students #29, 28, 18: [All looking in various texts and student #17 is looking on laptop].
Student #27: One more hint, white matter—it has got to be a tract. Student #28 has it—
Student #28: The M.L.F.
Student #27: Medial longitudinal fasciculus. One more. Think white matter. Cerebellar—what tracts?
Student #29: Inferior peduncle and the M.L.F. cause nystagmus.
Tutor: Look how much conversation you got. Frustration is a very powerful motivator to learn.

In contrast, questions posed by the tutorial group facilitators of the groups that continued the roundrobin format and produced only 30% of the critical case sample, were less frequent and tended to be more corrective and or informative. These tutors also appeared to be less comfortable with silence, and tended to ask one question after another when faced with the group's silence, not allowing the question to "land" in the group. The effect of this was that these groups did not struggle together to find or discover the answer in the context of the tutorial group itself. The groups remained silent, asked or expected the tutor to provide the answer or direction, or at best, asked a member of the group to bring in the missing information the next tutorial session. The following is an example taken from a tutorial group observation during the case break-down phase. Here the tutor assumes a very active role identifying the key issues of the case and topics she wants the students to research to prepare for the next

tutorial rather than allowing the group to struggle with identifying the relevant information and learning issues for themselves. The tutor's style of presenting a rapid succession of information without pause also impeded any opportunity for the students to independently identify the pertinent questions in the case.

> Tutor: [Reading from the case] "She's not interested in writing. She's fluent in English. Widowed nine years ago. Runs a grocery store. Successfully raised her kids." A survivor? Been motivated but now she doesn't want to do anything. We need to figure out motivation. A whole bunch of motor and sensory issues to figure out here. Figure out what the treatment would be. Basically your lab project. Shape them into topics.

Students articulated distinct advantages to their thinking in being allowed to struggle through solving unknown questions and missing information. As one student put it, "I understand the benefit of having almost little direction because you ask yourself more questions and often fix yourself." Another student articulated that his previous semester's tutor "helped" them more, but that this semester's tutor "didn't help us as much," citing this as an advantage in "really helping me think." Another noted that the tutor's deflections of questions back to the group "is a very good attribute" of the tutor's, one of the tutor's strengths, and that it helped the group think for themselves.

Internalizing the Tutor's Model of Critical Thinking

The tutor's constant questioning and challenging students on the information they presented and to think deeper, in effect served as a model for students that students internalized and adopted as their own. Students informed the researcher during interviews, that they gradually found themselves asking the same questions of themselves and the information they were researching when they were preparing for

tutorial as their tutors had asked them in tutorial. "[The tutor] did a good job at making us realize that—what we were supposed to be doing. As the semester progressed, [the tutor] started to ask us those questions and I started to ask them of myself." One student stated that she "never really asked [herself] these questions" until the tutor began to pose questions; then she "started to think about it." Several students articulated that when the tutor "started to ask us those questions, I started to ask them of myself." Repeated challenges to "delve deeper and make connections to others' topics" in each tutorial over the course of the semester resulted in the students beginning to challenge themselves and one another in the same manner. It became "not like second nature, but almost a given." One student described the internalization process:

> Just constantly having questions to provoke that thinking for you. It's more kind of like somebody tapping you on the shoulder and saying, "OK what does this mean?" You want to get to the deeper meaning and not just the superficial facts. I attributed it mostly to my facilitator and peers. And *eventually you start thinking that way on your own cause you know now what* they expect you to do.

Students soon began to extend this line of questioning to each other. Consistent repetition of questions and challenges on the part of the tutor, in turn modeled by student peers, thus resulted in the students' hearing and asking those same questions of themselves when preparing for tutorial. Observations of PBL tutorials confirmed that students began to model the tutor's questions; students would formally and informally pose challenges and questions to each other. In some situations, students would integrate a kind of quiz into their tutorial, asking a question at the conclusion of each piece of information they presented. Sometimes the quiz

would be more formal, where a student would be designated in the tutorial as the one to make up a quiz for the entire group to take at the conclusion of tutorial.

Making it Real: Application to the Case

A finding of equal magnitude was the tutor's skill in facilitating the students' ability to think about how the information they were presenting related to treatment and to the case. Even in PBL, where what is learned emerges from a clinical case as opposed to being conveyed in faculty lectures, it is easy for students to become focused on content learning: "You get so tied up in the information that you forget the patient. Especially since the patient is a piece of paper and not someone sitting next to you." Students eloquently expounded upon the tutor's facilitation and skill in connecting the information to the case, rendering it "alive." Clinical relevance and indeed the aliveness of PBL cases distinguished the method from traditional, lecturebased teaching by infusing content with life and meaning. The kinds of questions tutors asked students therefore surfaced as just as important as questioning itself. Questions that demanded students to determine how information was clinically relevant were crucial in developing students' clinical thinking. Clinical relevance after all, is the reason most students entered the occupational and physical therapy programs in the first place, so resistance to learning content diminished in the context of clinical application and meaning.

Students opined that one of the most important ways tutors facilitated their thinking was to constantly question them about clinical relevance which challenged them to think deeper about information. Students learned that it was not enough just to know information, it was also necessary to discern how it was pertinent to

occupational and/or physical therapy and the context of the patient's life. The fact that all PBL cases included contextual features in addition to the patient's age, gender, and condition, allowed students to view patients as a whole person. Students stated that in the second semester, they began to consider the patient's life contexts and situations as part of the case versus singularly viewing the clinical condition, impairments, or body parts requiring intervention. As articulated by one student:

> You know that you're not just treating a diagnosis and you know that you work with a whole person and there is more than an evaluation and just treatment or just—that there is a bigger part—everyone comes with extra stuff and I think we have a better idea of how these things fit together.

Tutors were observed to facilitate clinical application in different ways. Some tutors engaged students in role play exercises, assuming the role of the patient themselves in order to challenge students. Role playing challenged students to think about their choice of interventions and the effect their own interactions had on patients; students learned to ask themselves why one intervention or approach might be more effective with a particular patient than another. They also learned that in practice, interventions do not always go smoothly. Role playing challenged them to think about the possibility that, "Well this always won't work," so "What else can I do?"

Other tutors challenged students by continually asking, "Why do we care about that? What role does this [information] play in our patient?" This type of questioning brought students to the primary purpose of learning information in the first place: clinical practice.

Clinical application successfully made the study of academic content meaningful to students. Several students remarked that the opportunity to critically

analyze how information and research might apply to clinical practice made the content and research itself more interesting and easier to retain. Information "really sticks when it's related to a human being rather than just stuff you memorize from a book." Students felt that the opportunity to meaningfully relate information to the case, allowed them to see "why we are doing what we are doing," and it made learning "feel real instead of reading off paper or studying a textbook."

Students experienced tutors' questions that got them to "make it real" as the single most powerful way in which tutors facilitated their critical thinking. Students stated that even though they had obtained and understood all the content information, it was the tutor's challenging students to relate it to the case that made them think deeper about how knowledge might affect treatment with patients. As a result, students felt more prepared for fieldwork [supervised clinical practice].

The ability to see the relevance to the profession, clinical practice, the case, and the individual as a person in the case, was identified as a decisive change in thinking that students made over the course of the second semester from the kind of *thinking they were doing in the first semester. This finding was universally expressed* among the students who were interviewed, giving credence to two of Barrow's (2000) canons regarding the necessities of "authentic" PBL: (a) that case problems must be real patient problems presented in a format to allow students to engage in clinical reasoning as they would in practice; and (b) cases must include problems the practitioner is likely to encounter in practice including social and family issues, reimbursement, community health, etc.

The ProblemBased Learning Method

Students cited the PBL method itself as placing demands on their critical thinking and use of evidence-based practice. Most students compared PBL with traditional methods when conveying the differences each method had on their thinking and learning. Students reported that in "standard lectures, you can take it in or not, and you can do the reading or not," but that "flying under the radar was not an option in PBL." Once again, mutual responsibility for one another's learning was identified as critical to engagement in PBL. Students stated that the bond they felt with their peers in tutorials made them feel more committed, responsible, and engaged in the work of tutorial, and, that the work had become "more of a personal thing because you don't want to let them [one's peers] down." Students felt that PBL "constantly challenged" them, "engaged them in discussion," and demanded that they actually know and understand the material. One student went as far as to state that they "hated" the memorization that came with lectures and traditional learning, and that the integrative thinking required in PBL facilitated memory and learning as evidenced by better test grades over grades earned in traditional undergraduate courses.

The PBL tutorial process includes formally scheduled feedback at midterm and end of the semester to each student and the tutor regarding his or her performance in tutorial. Peer and self-evaluation is built in to the PBL method. Peer evaluation emerged as a commanding strategy to facilitate changes in students' professional behaviors, reflective practice, EBP, and critical thinking.

> The way the program is designed in particular, it's making you—there are times where it makes you do a critical analysis of yourself and you have to be

> able to sit back and take criticism and you have to be able to look at your own strengths and weaknesses. I was able to sit back and look at what I was doing and what [was] my strengths and weaknesses. Our evals—our midterm and final evals you have to be able to critically analyze yourself and your peers.

Continual peer and self-evaluation had the effect of facilitating reflective thinking which in turn had the effect of contributing to changes in students' use of EBP and critical thinking.

Evidence-based practice itself stimulated higher levels of critical thinking. In the course of searching and selecting research articles, students began to question the credibility of the source, the credibility of the research, and its application and utility to the case. This is indicative of Facione's (1990a) evaluative level of critical thinking outlined in his taxonomy. Some students moved to the level of inference, drawing conclusions and making inferences to the clinical case. The following are examples offered by students on how using EBP facilitated their critical thinking:

> If you have more research articles, it's going to spark more questions.

> I think that I had to do so much evidence-based research. To be able to read a lot and be able to be critical—to analyze the information critically and bring it back and present it to my group.

> Being more critical about methods and research and like reasons for doing it. It started from there and the more we—the more research we read we just kind of—then you start to ask questions of it. It becomes, not like second nature, but almost a given at this time. It wasn't necessarily like that at the beginning.

> Well for instance I was writing my [critically appraised topics] CATs on whatever topic I had and I would just report out on the [critically appraised topic] CAT and what the results were. Eventually I would start adding a section at the end under "additional comments" about how this related to the case we were doing. "This research may need more followup done, we have to take it with a grain of salt," or just "this is good for this population." By the end, I was able to find articles and relate them—they were a little out there—what was a good article—what was bad about it.

Peer and Tutor Feedback

Direct feedback from the tutor and one's peers emerged as a powerful instrument of change and growth in critical thinking and EBP. Students commented on the benefits and challenges of formally scheduled feedback in the form of midterm and final PBL tutorial evaluations, rotating feedback conducted at the conclusion of each tutorial session, and informal spontaneous feedback. One student articulated the benefits of feedback most succinctly, "I just need it. I can't grow if I don't get it." Feedback came in the form of "constructive criticism," challenges to advance skills, and assume a more facilitatory leadership role in tutorial. Students noted that feedback also "helped with professionalism and knowing how to say something. Being able to take the feedback and not get offended or defensive."

Feedback emerged as an important catalyst for evidence-based practice in particular. Feedback from one's tutor was highlighted as bringing about a turning point in one's thinking, work effort, professional behaviors, and use of evidence-based practices. Students frequently attributed changes in their use of evidence-based practices to feedback from tutors and peers. It was through direct feedback that tutors and peers effectively communicated the expectation to use and bring in more research evidence and to "back up" information presented in tutorial. Nearly half of the students interviewed remarked on the impact feedback had on their use of EBP. The following interview excerpts illustrate the power feedback had in initiating changes in students' use of EBP.

> The feedback, some of it wasn't so important to me, but some of it was. The research articles for example; because now I always write two [critically appraised topics] CATs and I don't use summaries anymore. So I definitely think the challenging and feedback had an effect on that.

> What played the biggest role was our first [PBL midterm tutorial] evaluation. My tutor said, "[Student #30], you bring great material to it you really use textbooks, resources everything. What I'd like for you to take the next step is to use more evidence-based things."

> Feedback affected evidence back up cause [the tutor] would always say, "Yeah, it was great what you said, but you have to back it up." It wasn't that [the tutor] was strict, you just knew from the questions [the tutor] asked that you did a good job on your research or that you should have gone a bit deeper.

> I would say probably peer and facilitator feedback because you may know yourself—I always knew myself that I needed to come in with more research articles I just didn't like wading through that material and I usually had one [research article] but everyone else had a couple more than I did. I know that I should be coming in with more research but when you hear your facilitator or peers say, "Why don't you just try coming in with a few more or just write a summary on these," it goes back to the whole peer pressure kind of thing.

Some tutors gave individualized feedback onetoone, outside the tutorial group session; others gave feedback in the context of the tutorial. The nature of individualized feedback tended toward facilitating students' assumption of a different role in the group. Sometimes it was to participate more, other times it was to try to assume a more facilitating leadership role. Typically, students seriously embraced onetoone feedback. Students used the feedback to set new goals for themselves in tutorial in the areas of leadership and participation. The tutors' feedback generally did not include specific suggestions for enacting changes, but its overall effect was to make the student "more and more aware" which allowed the student to "stay more focused" on their own behavior and goals.

Feedback was also noted to have a major influence on correcting inadequacies in preparation or evidence-based practices: "I think they give you feedback, constructive feedback that gets me to work harder." Students were given feedback that praised their effort, but informed the student that the information that they had

brought in was not what was expected or needed by the group. The researcher experienced several occasions during PBL tutorial observations where students gave each other feedback on what they wanted or expected of them in tutorial regarding the level, depth, and breadth of information they brought to the group. Students communicated to each other the expectation that if the information they brought in was not adequate, they were expected to either use the resources within the group to find the information at that moment or to research the information outside tutorial and prepare an additional handout for the group.

Context: Curricular Expectations: A Powerful Influence

Curricular Design

Changes in evidence-based practices (EBP) divided along lines of the OT and PT tutorial groups. The group of OT students consistently used and referenced evidence-based research in tutorial, whereas, the PT students as a group did not. The researcher collected and analyzed all student-produced handouts for the eighteen PBL tutorials she observed. Included in all the OT group handouts, was a minimum of one current research article reference and critically appraised topic summary (CAT). The study revealed that curricular expectations, not tutors' interventions, were the essential element that contributed to the difference. One OT tutor's comment on the *Self-Evaluation of EBP* provided evidence validating this: the tutor stated that she did not have to facilitate EBP because "students did it on their—it was a requirement." Since this research was conducted during the first year of the occupational and physical therapy programs, and the physical therapy program curriculum does not

expect students to integrate EBP into tutorial until the third year of the program, it is unknown if the PT students as a group would demonstrate use of EBP if this study was conducted over the course of the entire curriculum. Nevertheless, this finding indicates the importance of curriculum expectations with regards to facilitating EBP.

The occupational and physical therapy curricula at the university were designed and implemented using PBL from their inception. Although the structure, format, and procedures of the PBL tutorial groups are similar across the two programs, there are distinct differences in the curriculum design of each program that may have affected the expectations for EBP in PBL tutorials. Differences in curriculum and course expectations clearly appeared to influence the differences of students' use of EBP in PBL tutorials.

Curriculum and course expectations in OT program and in tutorials require all students in the second semester to include at least two critically appraised topics (CATS) in their tutorial presentations and handouts. The CAT is a structured outline summary and critical analysis of a peer-reviewed research article. The CAT format, developed by Straus et al. (2005), is taught and practiced in the research course offered in the first semester. Although the PT PBL tutors were observed to recommend the use of research articles in tutorial, neither the syllabus nor the PT adjunct faculty manual outlined specific expectations for including research as evidence in support of information presented in PBL tutorials. The one PT student who demonstrated and reported an increased use of research in tutorial did so as a result of individualized feedback he received from his tutorial tutor pushing him to the next level.

This study found that PBL methodology alone was not adequate to facilitate evidence-based practices and that specific instructional practices may be needed to facilitate this particular skill set. This finding was supported by the researcher's PBL tutorial observations, analysis of student handouts and curricular documents, and analysis of the pretest and posttest data of the *CCTST* and *Self-Evaluation of EBP*.

Occupational Therapy Curriculum

The occupational therapy program enrolled its first class in September 2000. The program consists of four academic semesters and 24 fulltime weeks of supervised clinical fieldwork leading to the master's of science degree in occupational therapy (MSOT). The curriculum is organized into several "streams of learning," with each stream focusing on content and skills needed for entry-level practice in occupational therapy. The streams include: occupational therapy foundations, assessment and intervention, research, health care and professional practice, professional interactions, and supervised clinical fieldwork. The PBL tutorial courses comprise the streams focusing on foundational theories and occupational therapy assessment and intervention. The PBL tutorial courses are the cornerstone of the curriculum. Additionally, students take two to three supporting courses each semester in each of the other learning streams to augment the tutorial course.

Problembased learning tutorial courses are organized in accordance with the developmental human life span; focusing on infants, children and adolescents in the first semester, adults in the second semester, and older adults and the elderly in the third semester. Curriculum content for the PBL tutorial courses is integrated. In the context of the PBL courses, students learn the foundational sciences and theories

from multiple disciplines, the diseases and conditions common to that stage of the lifespan, and occupational therapy assessments and interventions commonly used in that stage of the lifespan in an integrated manner rather than courses organized in a discipline-specific manner (See, Appendix D and Appendix E for course syllabi). The tutorial courses consist of several instructional activities: twice weekly, 3-hour PBL tutorial groups; twice weekly, 3-hour skills laboratories; 1-hour content lecture/seminar discussions three times a week; and, supervised clinical fieldwork one day per week.

Students progress through a specified sequence of increasingly difficult levels of critical analysis and evidence-based practices over the course of the three semesters in PBL tutorials. Students analyze and integrate information from multiple sources including research, biopsychosocial foundational theories, and occupational therapy frames of reference, with assessment information from patients' life contexts, goals, and preferences in everincreasing difficulty levels of complexity of critical analysis. The *OT PBL Tutorial Facilitator Training Manual* (Bortone & Darragh, 2005) clearly outlines expectations and guidelines for students in PBL tutorial by semester and offers guidelines to tutors on how to facilitate critical thinking and EBP.

Evidence-based practice expectations are incorporated into the PBL tutorial groups and students' handouts that they distribute each tutorial to their tutorial group. (See Bortone & Darragh, 2005 for tutorial expectations by semester, and Appendix D for the OT 514 Course Syllabus). The PBL tutorial courses include several course objectives specifically geared toward searching for, critically analyzing, and applying research evidence to the PBL case (See Appendix D for OT 514 Course Syllabus).

For example, by midOctober in the first semester, all students are expected to begin to bring to tutorial for discussion at least one CAT for each and every tutorial topic. By second semester, students are expected to bring in two or more CATs relevant to their tutorial topic for each PBL tutorial group. The CAT, originally developed by Sackett et al. (2000) and revised by Straus et al. (2005) is a specifically formatted guideline used to critically analyze and summarize research articles and is widely used in medical and health-care education and publications.

The Physical Therapy Curriculum

The physical therapy program enrolled its first class for the entry-level, Master's of Science degree in physical therapy in September 1996. The program began to offer the entry-level, clinical doctorate degree in physical therapy (DPT) beginning with the class entering September 2004. The clinical doctorate is differentiated from a research doctorate by its focus on preparing graduates for more advanced entrylevel clinical practice. The physical therapy program consists of six academic semesters and 38 weeks of fulltime supervised clinical fieldwork leading to the DPT.

The curricular content of the PBL tutorial courses in the physical therapy program are discipline specific and organized by specific subject/content areas: In the first year students focus on patients with disorders of the musculoskeletal and neurological systems. In the second year focus is on disorders of the cardiopulmonary, integumentary and genitourinary systems, and in the fifth academic semester, the students focus on ergonomic and environmental interventions.

Students are introduced to concepts of EBP as applied through special projects in the non-PBL supportive courses. The PT curriculum description differentiates the objectives for the PBL tutorial courses from the supporting courses:

> Using the PBL design, the tutorial based primary courses in the first year prepare students to understand the foundational components of normal movement through exploration of structure and function in functional anatomy, kinesiology, biomechanics, Neuroanatomy, neurophysiology, sensory/motor control, and the normal integration of these content areas through preliminary examination of posture and gait. The supportive courses integrate patient handling skills, patient interviewing, basic concepts in patient examination including tests and measurement issues, critical review of the literature, and the process of clinical decisionmaking (Faith-Based University, *Doctor of Physical Therapy, Curriculum Overview, n.d.*).

This statement highlights the fundamental difference regarding curricular objectives and expectations specifically with regard to evidence-based practices. The occupational therapy curriculum description, syllabi, and PBL tutor training manual specifically outline expectations and objectives for EBP in tutorial, whereas the PT curriculum designates expectations for EBP to the supporting courses.

In the second semester of the first year of the PT program, students immerse themselves in three related but separate courses: PT 612—Structure and Function II is the PBL tutorial course. Course content covers the structure and function of the typical and impaired neurological system and its impact on movement; PT 632—Evaluation and Intervention II includes interpretation and implications of patient history, goals, and assessment data to reason through intervention options and implications in the tutorial cases; and, PT 622—Examination and Documentation II uses the PBL cases from the tutorial course to practice PT assessment and intervention. *This course specifies a focus on EBP: "Students continue to examine* how to use evidence in practice by developing an understanding of and ability to

analyze and independently interpret the range of issues affecting statistical and clinical inference in a published research, including individual studies, systematic reviews, and clinical practice guidelines" (Faith-Based University, Doctor of Physical Therapy, Course Descriptions, n.d.).

The fact that the OT group increased their use of research evidence significantly as compared to the PT group, suggests that instructional practices in PBL tutorials require specific enhancements to facilitate EBP, and, that the PBL method does not, as expected, lend itself to increased use of research evidence in thinking about clinical decisions during PBL tutorials.

Summary

Major findings included significant changes in four areas in which students overwhelmingly reported that they experienced significant improvement in their *critical thinking and critical analysis; becoming more efficient and effective in* conducting research in preparation for tutorials; and searching for; using; and *evaluating research evidence. About half of the interviewed students also reported* increased comfort with participating in tutorials and noted that their role in the tutorial group changed substantially from the first semester.

A major finding of this research was that students felt a great deal of mutual interdependence on their tutorial groups for learning. As individuals, students expressed a profound feeling of responsibility for their peers' learning and, in turn, felt that their peers were responsible to them. Further, students genuinely accepted one another's diverse levels of ability and learning styles within the tutorial groups. Some students were perceived as struggling to find and understand the academic

content information, while others were openly acknowledged as significantly more advanced in their ability to search out and comprehend information. While these findings in and of themselves were not surprising, the level of personal commitment and emotion students expressed regarding their commitment to their tutorial groups and willingness to accommodate for the less advanced students was a surprise to this researcher. The instructional practices that effectively facilitated critical thinking and EBP will be addressed separately as the findings yielded different results for each. Critical thinking appears to be facilitated by tutors and peers and through the PBL method itself. Evidence-based practices, while also facilitated by tutors and peers, seems to be substantially impacted by curricular and course expectations. The OT tutors reported that they did not think themselves to be particularly skilled at facilitating the use of evidence-based practices in tutorial but that given the course requirements for students to bring in CATS and research evidence to each tutorial, they did not feel a need to specifically facilitate EBP. The two OT tutors reported that the "students did it themselves" and they did not really have to specifically facilitate EBP.

CHAPTER V

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Summary

The escalating emphasis on accountability for effective health-care outcomes for occupational and physical therapy compels practitioners to employ evidence-based practice (EBP) to demonstrate that "what [they] do and how [they] do it really works" (Holm, 2000, p. 575). Occupational and physical therapy practitioners are required by third-party payers to document that the treatment interventions they use are effective in facilitating desired outcomes as demonstrated by credible, valid research. Embedded within EBP are the metacognitive skills of critical thinking and reflective practice (Facione, 1990a; Straus et al., 2005); processes allowing students to scrutinize ideas, recognize problems, logically assess evidence, and identify and correct gaps in their own knowledge, skills, and reasoning.

Critical thinking entails assessing the credibility of information from multiple sources including the patient, theory, research, and experience. Students must then synthesize the information to formulate a new understanding of the clinical problem and ascertain the best possible intervention approach based on research evidence. Occupational and physical therapists must also become "reflective practitioners" (Schön, 1983). They must identify their own knowledge, skill, and reasoning strengths, as well as gaps. They must also uncover the biases and emotions that affect

their interactions and practice. Reflective practice is an essential component of critical thinking (Facione, 1990a; 1998; Schön, 1983; Williams, 2001).

Occupational and physical therapy education programs are being held accountable for their graduates' preparedness for the world of practice. Students' acquisition of vast amounts of content knowledge and psychomotor skills are no longer deemed adequate outcomes for health care education (Barrows, 1985; Gillespie, 2002; Margetson, 1994; Straus et al., 2005). Rather, occupational and physical therapy educators are expected to prepare students to think critically and analytically, use EBP, develop interpersonal skills for collaborative teamwork and problemsolving, and internalize the profession's values and ethics into their identities (Barrows, 1985; Doucet et al., 1998; Gillespie, 2002; Margetson, 1993; Sellheim, 2001; Straus et al., 2005).

In health care education, which includes occupational and physical therapy, the problembased learning (PBL) method has frequently been selected as an alternative to traditional lecturebased methods, and is viewed as a more viable approach to teaching critical thinking and EBP (Albanese, 2000; Caterina & Stern, 2000; Solomon, 2005; VanLeit et al., 2000). However, the efficacy of the PBL method is widely debated in the empirical literature. Little research exists on two of the most importantly identified outcomes of PBL: critical thinking and EBP. Additionally, the nature of the PBL instructional practices that may or may not facilitate students' critical thinking or EBP has not been the subject of systematic empirical study.

This study sought to discover the relationship between the PBL facilitators' instructional practices and the influence they had on the development of students' critical thinking and evidence-based practices in tutorial groups. The research first sought to ascertain if instructional practices in PBL tutorial groups facilitated critical thinking and evidence-based practices (EBP). Subquestions sought to discover if students' critical thinking and use of EBP changed over the course of the semester in PBL tutorials. Specifically the research sought to identify; the changes students made in their critical thinking and EBP; the instructional practices used by tutors and students, the curriculum expectations, and group process variables that influenced students' critical thinking and EBP; and, the specific instructional strategies and practices that may be needed to facilitate critical thinking and EBP.

The researcher used a two-case, critical case study design, one type of qualitative research methodology, to explore the nature of the relationship between the PBL facilitators' instructional practices and the students' development of critical thinking and EBP. Two quantitative measures, a pretest and posttest of the *CCTST* and *Self-Evaluation of EBP*, were used to select the critical case sample and to determine if PBL tutorials facilitated the development of students' critical thinking and evidence-based practices. The sample included thirty first-year, second-semester students and six PBL tutors from the occupational and physical therapy programs at a faith-based university located in suburban New England. The two-case method and the triangulation of multiple sources of data offered increased credibility to the study and allowed the researcher to test the plausibility and confirmability of the findings. This methodology can lead to a richly detailed discovery of the phenomena that were

being studied and the meaning the changes in learning held for the students (Delamont, 2002; Merriam, 1998; Miles & Huberman, 1994; Patton, 1990). Data collection included a total of 18 ethnographic observations of the 6 PBL tutorial groups on 3 separate occasions throughout the semester; interviews with 10 students meeting selection criteria for the critical case sample; and, analysis of curricular, course, and student-produced PBL documents.

The findings of the study indicated that students made significant improvements in their critical thinking and EBP. The research also uncovered the essential elements of PBL tutorial groups and instructional practices that contributed to the development of students' critical thinking and EBP. This chapter includes a discussion of the findings, beginning with a discussion of what was learned through each aspect of data collection. Then follows a discussion of the major findings, in relation to the empirical and theoretical literature. The chapter concludes with recommendations for educational leaders and future research.

Components of Data Collection

Quantitative Data

The first component of data collection included calculating the effect size of changes students made in their critical thinking and EBP as measured on a pretest and posttest of the *CCTST* and the *Self-Evaluation of EBP*. Effect size changes indicated that the pooled group of occupational and physical therapy students made improvements in both their critical thinking and EBP in the PBL tutorial process: The OT group demonstrated a medium effect of d=0.64 and the PT group a small effect of

d=0.19 on the preto posttest of the *CCTST*; and the OT group demonstrated a large effect of d=0.85 and the PT group a smallmedium effect of d=0.39 on the pretest to posttest of the *Self-Evaluation of EBP*. (See Table I for these data). Given the short time lapse between the pretests and posttests and the numbers of students who made gains on their critical thinking and use of EBP, the small effect-size changes are considered significant (Glass et al., 1981).

Ethnographic Observations

The second component of data collection, the ethnographic observations, allowed the researcher to fully immerse herself into the culture of each tutorial group. The researcher experienced the students to be especially welcoming inviting her perspective, providing her with handouts and orientation to the groups' processes, and taking genuine interest in her dissertation research. The students frequently extended themselves to the researcher beyond expectation in their commitment to participate in the research process and welcomed her into their tutorial groups. In this manner, the researcher was able to experience firsthand each group's culture, struggles, and dedication to the tutorial process. The researcher's experience of the group's culture contributed to the finding that the mutual responsibility students had for one another's learning was felt as deeply personal and emotional, a finding that was independently substantiated in the student interviews. The students' enthusiastic openness and vulnerability to an outside observer, who is also an administrator at the University, was an immensely appreciated and unanticipated gift. At the same time, the researcher was conscious of her role as an observer and administrator and tried to understand the implications and effects that had on the data-collection process.

On occasion, the researcher found herself falling into or being invited into the role of participant; sometimes asking or answering questions as an occupational therapist or as someone with extensive knowledge of PBL. Her participation in these instances may have biased the tutorial interactions, particularly at the time of the interaction, but it is unlikely that they affected the overall results of the study as findings were substantiated through multiple sources of data. Additionally, facilitators sometimes asked the researcher for feedback on their PBL facilitation. In these situations, the researcher took great care not to give direct feedback, citing the potential for bias if she should engage in this practice, and reiterated her willingness to share the findings with students and facilitators once the study was completed.

Interviews

The third component of data collection, the interview with the 10 students meeting criteria for the critical case sample, provided the researcher with the opportunity to gain entry into the students' own perceptions and experience of the PBL tutorials, their tutors, peers, and their own growth. The interviews offered insights that could not have been acquired through any other method, but could be validated through corroborating evidence from other sources of data. For example, although the researcher was able to experience variations in the culture of commitment among the different tutorial groups, it was only by interviewing students that she was able to comprehend that students experienced their commitment to their tutorial group as deeply personal and imbued with emotion, and, understand that the personal nature of the peer and tutorstudent relationships contributed to the variations in the culture of commitment in the different tutorial groups.

Interviews also revealed that individual student's dispositional characteristics and goals played a significant role in motivating individual students to changes in what they did and how they did it in tutorial groups. Disposition was shown to be a major factor in students' commitment to the PBL process, to the tutorial group, and to changes students made in their critical thinking and EBP. While changes in critical thinking and EBP could be observed during the ethnographic observations and could be measured on the pretests and posttests of the *CCTST*, the interviews revealed that the motivation behind these changes was highly individualized according to each student's disposition. This gives credibility to Facione's (1990a; 1990d) postulate that students must possess the right mix of dispositional characteristics in order to become good critical thinkers. Although the Facione's (1990a; 1990d) theory of critical thinking hypothesized that certain dispositional characteristics are prerequisite to good critical thinking, identification and exploration of students' dispositional characteristics as they might have affected critical thinking and EBP was not a question of this research study. However, this finding emerged as an important secondary finding and one that validated Facione's (1990a; 1990d) hypothesis.

Document Analysis

The final component of data collection, document analysis exposed an important finding with respect to students' learning and using evidence-based practices. Analysis of curricular and course documents revealed that curricular expectations strongly influenced whether or not students routinely engaged in EBP in preparation for, and during PBL tutorial discussions. The occupational therapy curricula and course documents articulate expectations for students to use research

evidence and include CATs as part of each and every tutorial handout and tutorial discussion. These expectations are outlined in the course syllabus and the Occupational Therapy PBL tutor training manual, and the use of EBP was evident in student tutorial handouts and was observed during PBL tutorials (Bortone & Darragh, 2005; [Faith-Based] University Doctor of Physical Therapy, 2005). The physical therapy curricular and course documents do not articulate requirements that students routinely use EBP as part of PBL tutorials until the third year of the curriculum. Although all the physical therapy tutorial facilitators were observed frequently reminding students to use the research journals as sources of information, only one student was observed to routinely use EBP. This individual did so as a result of individual feedback he received from his tutorial facilitator to push himself to the next level.

The research sought to answer the question, "Are specific instructional practices needed to facilitate critical thinking and EBP?" While tutors' constant challenging, modeling of critical thinking and questioning, and feedback emerged as the major practices that facilitated critical thinking, curricular design emerged as the predominant instructional practice that affected the students' use of EBP in PBL tutorials. Curricular expectations for EBP appear to be selfperpetuating when clearly articulated in the curricular design and evaluated for grading. It appears that curricular and course design powerfully influence students' use of EBP and may well constitute the essential ingredient to students' ability to use this skill in PBL tutorials. Tutors did not feel that they needed to directly facilitate EBP. For example, both occupational therapy tutors reported that they did not need to expressly facilitate

students' use of EBP "because it was expected by the syllabus" and students "did it on their own." Furthermore when tutors were observed to encourage students to bring in research evidence and use EBP, the directive had little to no effect. Although the PBL course may be the ideal course for students to practice using EBP skills and apply research evidence to clinical cases, it may not be the most appropriate course context in which to learn evidence-based practice skills as students in both programs reported that they learned how to find, read, and understand research in the supportive research courses and not in PBL courses.

Discussion of the Major Findings

This study sought to identify the essential instructional practices and factors within PBL tutorials that successfully facilitated students' critical thinking and evidence-based practices (EBP). The study's findings uncovered four principal elements that most powerfully influenced the development of critical thinking and EBP in the context of PBL tutorials: (a) Group culture and format, (b) the tutor's modeling critical thinking through questioning and struggling to discover answers, (c) curriculum context and the PBL method itself, and (d) tutor and peer feedback. The tutor's skill further emerged as key to setting the group's tone, initiating group format changes, and establishing group culture. Individual student dispositional characteristics also came to light as central to the overall development of each tutorial group's culture of commitment. This section will discuss each element in light of the literature and the analysis through triangulation of data.

Group Culture and Format

The tutorial groups that produced the 70% of the critical case sample were remarkable for their culture of commitment, evidence of mutual responsibility for learning among students, and collaboration among student peers and faculty. The skills of the tutor and individual student personalities were revealed as critical elements in facilitating the group's tone, culture, personality, and format. These groups shared resources and ways of solving case problems, and encouraged one another to take risks and explore new behaviors and ways of doing things. In this manner, these groups fit the description of "communities of practice" as defined by Wenger (1998).

A culture of commitment and collaboration emerged as a major finding in this study. Collaboration for learning is discussed frequently in the literature as essential to developing higher orders of critical thinking. Several studies identified PBL as facilitating critical thinking. (See for example, Biley & Smith, 1998; Birgegard & Lindquist, 1998; Pang et al., 2002; Stern, 1997). Other studies examine the effect of cooperative learning in small groups had on group productivity and critical thinking. Gabbert, Johnson, and Johnson (2001), for example, found that cooperative learning in small groups was more effective in facilitating the higher orders of critical thinking. Pereles, Lockyer, and Fidler's (2002) research into continuing education permanent small groups of practitioners identified a culture of collaboration, support, and relationships among members as critical to creating a community of practice.

The theoretical literature identified collaboration and a collaborative facultystudent focus on learning versus facultydirected or studentdirected focus as

key to learning, critical thinking, and/or use of EBP (American Psychological Association Task Force on EBP, 2006; Gabbert et al., 2001; Pereles et al., 2002). The literature discusses the importance of collaboration and cooperative learning; however, none of the empirical literature directly examines collaborative partnerships between students and faculty or the optimal culture of PBL tutorial groups. The findings of this study in combination with the absence of empirical study of collaborative facultystudent partnerships and tutorial group culture, highlights the need for systematic research into the effect of tutorial group culture and collaborative facultystudent partnerships on student learning.

Tutor's Skill in Establishing Group Culture and Format. Setting the tone for learning, successfully transitioning from a reportingout format of individualized mini lectures to group discussion, a group tone characterized by humor, support, and friendship, and a culture of commitment emerged as major contributors to the development of students' critical thinking and use of EBP. The skill of the tutor in establishing collaborative partnerships between the students and the tutor emerged as the critical element in creating a culture built on mutual respect, collaboration, and commitment. The findings of this study reinforced Barrows's (2000) claim that the skill of the tutor is essential to the tutorial group's success. The findings suggest that the "skill" that is most important may be the tutor's ability to transition from the traditional role of a faculty member who is a content expert compelled to impart information, to one who is expert in creating culture and building learning-collaborative partnerships with students. Dolmans, Wolfhagen, van der Vleuten, and Wijnen (2001) emphasize that PBL faculty tutors and course instructors ought to

adhere to the underlying PBL educational philosophy and resist falling to the more comfortable, familiar role of faculty as expert and faculty-directed learning if they want PBL to be successful. Recent literature takes a more moderate approach in concluding that tutors need skills and expertise in both content and group process (Solomon, 2005).

Problem-based learning tutors need to be able to use their content expertise to facilitate student's learning. They need to transform their urge to impart information with statements into questions and set a group tone of inquiry, trust, risktaking, and commitment. Student participants in this study identified the most highly skilled tutors as those who could maintain this balance of "helping" students by providing information and answers, and facilitating students to "work out the answers" themselves.

Furthermore, students recognized tutors as the architects of the group process. Tutors were responsible for creating an atmosphere where students felt free to make mistakes, question the tutor and one another, and give and receive feedback. Students commented that the tutor's ability to use humor in interactions with them helped to facilitate an atmosphere that was conducive to learning. They identified the skilled tutor as one who managed the "fine line" between letting them struggle to figure things out on their own, and intervening.

Students took pride in the fact that their own feedback to the tutor was instrumental in facilitating the tutor's learning how to negotiate this line. The tutor's openness to accept feedback from students and change their interactions and facilitation style in tutorials created an atmosphere of collaboration between student

and the tutor and affirmed the freedom to make mistakes, to change, and to grow. Silén's (2006) phenomenological study of the tutor's approach identified student feedback to tutors as critical to the tutor's ability to reflect on their own approach and be "present" in tutorial groups: She pinpoints the tutor's "presence" and self-reflection as the essential ingredient enabling tutors to respond to the group's process and build on the group's learning activities.

In all the tutorial groups, the tutor was also recognized as initiating the suggestion to change the way things are done in tutorial: To change the format from reportingout roundrobin style to a group discussion. Students in the groups that successfully made the transition stated that even though the tutor suggested the change, it was the group's decision to actually make the change. Although students identified their own group as the primary instrument in transitioning to the discussion format, it was the researcher's observation that only the groups that persevered in mutual problemsolving between tutor and students actually succeeded in making the transition in format and produced the most students who met the criteria for the critical case sample. The researcher experienced collaborative partnering between students and the tutor as extraordinary in the tutorial groups that successfully made the transition but notably absent in the groups that failed to make the transition. The researcher's emotional experience of the successful groups was one of contagious excitement, collaboration, openness, and enjoyment. Time flew by quickly in these groups. In contrast, she experienced the groups that kept to the roundrobin format as slower, less interesting, and sometimes tense.

Learning to work collaboratively is a stated outcome of PBL and is considered to be a core competency of health care occupational and physical therapy education (Accreditation Council for Occupational Therapy Education, 2006; Barrows, 2000; Chaves, Baker, Chaves, & Fisher, 2006). However, collaboration generally refers to the graduate's ability to collaborate with future clinical team members and among student peers, and not necessarily to collaborative partnerships for learning between faculty tutors and students. Although the theoretical literature talks about an underlying PBL philosophical value of establishing respectful, collaborative facultystudent partnerships, there is a lack of empirical study on the existence of, or effect of, collaborative partnering between students and tutors. Several studies allude to the relationship between tutors and students and tutorial group learning outcomes. Dornan et al.s' (2005) phenomenological study of clinical educators and PBL, found that over and above any other factors, the participants identified the "personal relationship between teacher and learner" as essential to learning (p. 169). Even though Dornan et al.'s (2005) study identifies the personal relationship between clinical supervisors and students, the authors appeal to health care education faculty to replicate this type of relationship in PBL tutorials to prepare students for health care careers. Baptiste (2003), Dornan et al. (2005), and Silén (2006) discuss the necessity of the tutor to step out of the traditional faculty role of expert imparter of information, into a role of collaborative partner in learning based on mutual respect and honesty, where both tutor and students learn in PBL.

Some studies examine the relationship between the tutors' expertise and the tutorial groups' productivity and the tutors' grading and the groups' productivity and

students' perception of PBL. (See for example, Dolmans, et al., 2006; Dolmans & Wolfhagen, 2005; Neville, 1999; Stevenson, Bowe, Gandour-Edwards, & Kumari, 2005; Trevena, 2003). These studies alluded to the possibility of collaborative partnerships between PBL facilitators and students but do not address it specifically. Rather, they examined the impact of the tutor on the student as two separate entities but did not look at the relationship between the two as persons in partnership or the effect that relationship might have on group productivity. The research suggests, however, a vital relationship between the tutor and a group's productivity. For example, Dolmans and Wolfhagen (2005) identify the skilled, "high performing" tutor as one who successfully facilitates collaborative learning and the "productive" group as one distinguished by a high degree of motivation, interaction, and cohesion.

Barriers to creating collaborative relationships between faculty and students have been identified in the literature. Pang et al. (2002) observed PBL groups that failed due to "group process" issues. The authors identified group culture issues such as the lack of motivation, students' inability to transition to self-directed learning, and students' lack of commitment to the PBL process as contributing to the PBL group's failure (Pang et al., 2002). Bowman and Hughes (2005) focused on "unprofessional behaviors" of tutors that interfere with collaborative partnerships: Tutors who therapize students, try to be "one of the gang," keep control by being the expert, and/or form personal relationships with students are behaviors noted to interfere with collaborative partnerships. Green and Ruff (2005) identified the tutor's "talking too much" as a distinct barrier to students' development and use of EBP. The results of these studies support the findings of this research that the tutor's skill in establishing a

group culture of commitment and mutual collaboration while resisting the temptation to "teach" are critical to a PBL tutorial group's success.

The findings of this study call attention to the benefits of creating collaborative partnerships between faculty and students in PBL tutorials. Students felt that the shift in the faculty tutor's role to one of facilitator, guide, and manager of the "fine line" between giving information and letting the group struggle as imperative to their learning to think critically. The researcher's observations that some tutors had more difficulty with shifting roles and creating partnerships than others were validated by student interviews. Those tutors who were able to hear and use student feedback with regards to their own kind of participation, and who were able to assume the role of guide, were more successful in facilitating the collaboration with students.

True collaboration with students requires a departure from the usual faculty role and beliefs about education. Hitchcock and Mylona's (2000) analysis of the literature on PBL tutor training documented that successful PBL tutors departed from traditional teaching patterns when they did not serve as either the "source of information or the leader of the learners" (p. 53). The authors noted that the PBL method requires tutors to redefine their relationships, assume new roles, and acquire different skills germane to PBL. They noted that many faculty tutors struggled with the transition or were completely unable to make the transition and this was evident in this study (Hitchcock & Mylona, 2000).

Some tutors in this study were observed holding on to the traditional faculty roles and directing students what to look for and what to do. They outlined the

learning issues for the students, highlighted the relevant issues in the case for student, *told students instead of asking, did not allow students to struggle to answer questions,* and engaged in a rapid succession of questions without allowing students time to answer. These tutors appeared to hold on to traditional teaching values of efficiency and making sure all content was covered. There was little evidence in these tutorial groups of collaborative partnerships and greater dependency on the tutor existed than in the groups where it was evident that the tutor made the role transition.

The findings of this study and those identified in the empirical research at first analysis appear disparate with regards to the tutor's role in creating culture. However, it is evident that a culture of commitment, an atmosphere of trust, respect, and freedom to risk making mistakes and be wrong, and collaboration between students and tutors are essential for facilitating critical thinking and EBP. Tutors who are able to redefine their role, who are able to listen to students' feedback, evaluate and change their own behavior, ask questions instead of tell, tolerate silence, allow students to discover the answers, and who themselves are dedicated to the students and the PBL process, are successful at creating group cultures that are conducive to critical thinking and EBP.

Influence of Students' Dispositional Characteristics. Individual student's dispositional characteristics were found to be equally instrumental in establishing a culture of commitment in the tutorial groups. The students who met selection criteria for the critical case sample uniformly expressed a deep commitment to the PBL process and to their tutorial group. This commitment was experienced by the students as deeply personal and emotional with relationships frequently extending outside the

tutorial group. The poignant nature of the students' commitment to their tutorial groups came as a surprise to the researcher. Students attributed the personal and emotional nature of their commitment to their own specific personality characteristics. Further, students felt that their personalities predisposed their ability to engage in critical thinking and EBP. Students credited their self-directedness, natural curiosity and propensity to "look things up," willingness to change based on feedback, and work ethic, as prominent in learning how to think critically and engage in EBP in PBL.

The literature supports the idea that personality characteristics are important to learning, although there is little agreement as to what those characteristics are (Albanese et al., 2003; Dolmans & Wolfhagen, 2004; Green & Ruff, 2005). Green and Ruff (2005) identified self-directedness, assumption of responsibility for learning, and commitment as essential dispositional characteristics necessary for students' development of EBP. Albanese et al. (2003) examined the literature in an attempt to identify the personal qualities of students that were relevant to the practice of medicine. They found 87 different characteristics with seven emerging as more compelling than others: "compassion, coping capabilities, decision-making, interprofessional relations, realistic selfappraisal, sensitivity in interpersonal relations, and staying power" (Albanese et al., 2003, p. 317). There is limited overlap between the characteristics identified by Green and Ruff (2005), Albanese et al., (2003) and the dispositional characteristics considered prerequisite to critical thinking identified by Facione (1990a). Facione (1990a) and Giancarlo and Facione (2001) for example, postulated that the dispositional characteristics of curiosity, openmindedness, and

diligence are prerequisite to developing good critical-thinking skills. Diligence and self-reflection are two characteristics that overlap as articulated in the literature. Discovering the most compelling dispositional characteristics that are predictive of students' development of critical thinking, use of EBP and performance in PBL tutorials thus emerges as a critical area for future research.

The findings of this study confirm that in students' opinions, dispositional characteristics are important to the development of critical thinking, EBP, and to creating a culture of commitment in PBL tutorials. In this study, students appeared to be motivated by different things although shared the characteristics of "self-directedness" and hard work. The critical case sample consisted of only the students who could be considered exemplary and they were the only students given the opportunity to identify the characteristics that were influential to their critical thinking. It would be fascinating to learn whether or not the other tutorial group students shared similar dispositional characteristics and if they were considered to be compelling in developing critical thinking, EBP, and commitment. The findings raise the question: To what extent the students' dispositional characteristics contribute to their growth and learning? The finding that students' dispositional characteristics may be prerequisite to good critical thinking, may have implications for student recruitment and admissions into PBL curriculum. These implications will be discussed in greater detail in the section on Implications for Practice and Administration of this chapter.

Internalization of Tutor's Skill and Modeling

This study found that over the course of the semester, students gradually internalized the tutors' questions for use during their preparation for and participation in tutorial groups. Students uniformly reported that the constant repetition of the tutor's questions became like, "somebody tapping you on the shoulder and saying, "OK what does this mean?" The "tap on the shoulder" metaphor beautifully captured the internalization process and effectively reminded students to think critically.

The kinds of questions and statements students cited students as most helpful were "Why?", "What else?", "Is that important for us to know?", "How does that relate to the case?", and "That's good information, now back it up." These types of questions and statements challenged students to think deeper and explain their reasoning for the conclusions they drew. Student participants expounded on their tutor's relentless persistence in questioning them. Frequent, brief questions maximized the students' ability to internalize the tutor's model of critical thinking. Furthermore, the tutors of the discussion-formatted groups that produced the greatest numbers of students meeting selection criteria for the critical case sample, questioned students twice as frequently as the tutors of the PBL tutorials that produced fewer students who met the selection criteria. The types of questions that tutors asked that were internalized by students in this study are almost identical to the critical-thinking questions that students internalized in Williams (2001) research:

> Over a period of time learners will begin to challenge themselves and each other with "What?", " How?", "Why?", "What makes me/you—?", and "What do you think would happen if—?" types of questions. When this happens learners exhibit increasing autonomy in critical reflection. (p. 32)

The idea that students build a professional identity though social interaction is well documented in the literature. Barrows (1988; 1998) identified the tutor's ability to model critical thinking and promote effective discussions in PBL tutorials as critical to helping students' internalize critical thinking, a hypothesis that has been validated by recent empirical study (Dornan et al., 2005; Visschers-Pleijers et al., 2006). Visschers-Pleijers et al. (2006) linked the tutor's modeling of critical thinking to the quality of tutorial group discussions. Additionally, Bowman and Hughes (2005) found that PBL tutors effectively promoted learning through the modeling of critical thinking. The body of empirical research validates this study's finding that students internalize critical thinking through tutors' modeling of critical questioning. The findings highlight the need for tutors to consistently pose metacognitive challenges to students in tutorial groups until students internalize this reasoning and become proficient in their own critical thinking.

Context and the Problem-Based Learning Method

The PBL method and curricular expectations were found to powerfully influence the development of critical thinking and EBP. Inherent in the PBL method is the demand for self-directness in learning, application of information to real clinical cases that include complexities of the patient's life, and the constant evaluation of information and sources. Additionally, the use of EBP in and of itself was found to facilitate critical thinking. Students reported that the PBL process demanded that they constantly search the empirical research for information as to how an assessment or intervention might apply to the clinical case. In the pursuit of research evidence, students found that clinical trial results sometimes conflicted with

each other. Conflicting information made them question the credibility, validity, and utility of the studies they were reading thereby increasing their critical thinking. This finding was consistent with what was found in the theoretical literature with regards to PBL and EBP. Evidence-based practice is a process based on a systematic series of inquiry, evaluation and reflection. It incorporates but is differentiated from critical thinking through its focus on analysis and application of research evidence (Straus et al., 2005). It is through using EBP that student and/or practitioners have the opportunity to think critically and analytically.

All of the interviewed students remarked that the PBL method demanded that they think about how the information they uncovered could be applied to reallife clinical cases. Clinical relevance was identified as invaluable to their learning and the most important element of PBL learning. Opportunities for clinical application to the PBL case rendered the information and the process of learning relevant and highly meaningful to their vision of themselves as future practitioners. The relevance of clinical application was uniformly appreciated by not only the students who comprised the critical case sample, but other students in the tutorial groups. Barrows (1998; 2000), as a hallmark of "authentic PBL," identified the fact that reallife clinical cases served as the impetus for learning. The findings of this research bore this out. The content and context of learning in PBL must adhere to PBL philosophy and replicate what is found in clinical setting in order to facilitate good critical thinking and clinical decision-making in students (Dornan et al., 2005). Collaborative application of information and solving clinical problems of a case in PBL tutorials

most closely approximates what happens in the clinical setting. As one student aptly put it, "it's as close as we can get."

Curriculum design and course expectations emerged as a highly important contextual element influencing the use of evidence-based practices in particular. The occupational therapy students, as a group, were found to routinely use EBP whereas the physical therapy students, as a group, did not. This was the only finding in this study that divided along program-group lines. However, students in the physical therapy curriculum are not expected to begin to integrate the use of EBP into tutorials until the third year of the program. While students in both programs demonstrated changes in their critical thinking and shared perceptions about what contributed to those changes, the use of EBP was markedly different among students from the two programmatic groups. The occupational therapy PBL course expectations require the use of EBP with critically appraised topics as part of preparation for all tutorials, whereas the physical therapy curriculum did not share the same expectation of students for PBL tutorial preparation and performance. It is not known to what extent physical therapy students will use EBP in PBL tutorials in their third year. Nonetheless, curriculum design emerged as a critical ingredient in facilitating EBP in particular. If the curriculum design clearly articulates expectations for EBP and grades students' use of EBP, then students will use EBP in application to their PBL cases.

Together, the contextual element of adherence to a curriculum design incorporating Barrows's (1998; 2000) "authentic PBL" along with a skilled tutor strongly influences the development of students' critical thinking. However, the PBL

method itself appears to have little influence over the students' development or use of EBP. *This has implications for educational leaders when leading faculty in* curriculum design. First, educational leaders must work with faculty tutors to make sure that they buy into and adhere to the PBL educational philosophy and gain the necessary skills to guide, facilitate, model, and question rather than tell, teach, and talk. Educational leaders must determine what PBL goals, in what sequence, are desirable for the curriculum. The curriculum expectations then must be aligned with the teaching-learning method to achieve those goals. Since EBP is a stated outcome of PBL, this finding also has implications for future research examining which of Barrows's (1985) PBL outcomes are being achieved and under what conditions.

Tutor and Peer Feedback

Feedback in various forms ushered in changes in students' critical thinking and use of evidence-based practice. Constructive criticism and challenges to advance skills and assume greater leadership in tutorials were identified as examples of helpful feedback. Expectations to think critically and use EBP were communicated through direct feedback from tutors and peers. Students noted that feedback also helped develop their professional behaviors, decreased defensive reactions, and increased self-reflection. Students remarked that both formal feedback during the midterm and final evaluations, and at the end of tutorial, and informal spontaneous feedback, were equally important to and effective in facilitating their thinking, their use of evidence, and way of working in the group.

Although students appreciated feedback from both tutors and peers, they valued the tutor's feedback as most important in facilitating changes in their

behaviors, thinking, and goals. Students did not value all feedback equally. During the routine self-and peer-evaluation at the conclusion of the tutorial session, students and the tutor rotated turns in receiving feedback from the group on their performance. Students reported that the feedback they received during this process was intermittently meaningful—sometimes the feedback was seen as too general and other times it facilitated changes in thinking and behaving. The feedback students received individually from the tutor was valued most highly and compelled students to make changes every time it was given. Additionally, students interpreted as feedback a kind of competition when they perceived their peers as producing superior work; they wanted to do at least as well and adjusted their performance accordingly. The regard with which students held feedback as found in this research is supported by the work of Parikh, McReelis, and Hodges (2001).

The importance and meaning of feedback particularly from the tutor is well documented in the PBL literature. Solomon (2005) and Winning, Lim, and Townsend (2005) identify feedback as an essential role function for tutors and the most important aspect of assessment in PBL tutorial evaluation. Silén (2006) and Barrows (2000) connect feedback with learning to be a reflective practitioner. They contend that it is through feedback that students learn the process of self-reflection, and that continuous self-reflection is imperative to identify and correct skill and knowledge gaps. Both the importance of feedback and its instrumentality in facilitating self-reflection was observed in this study.

Implications for Practice and Administration

The findings of this research point to several implications for practice in educational leadership, curricular design, course expectations, and PBL tutor and faculty education and supervision. These implications may be of importance to faculty, tutors, and department chairpersons of PBL curricula. They may also be of interest to faculty and department chairs of traditional, lecturebased education programs for consideration as to how best to operationalize the educational philosophy underpinning the educational pedagogy selected for the curriculum.

1. *Educational leaders must assume active leadership of faculty in designing curriculum to identify pedagogy, incorporate the appropriate educational philosophy, and assure that all courses within a curriculum are integrated with one another. Seamless integration of individual courses into a coherent whole runs contrary to* many graduate curriculum where faculty teach the courses in which they are expert and/or foundational-level overview courses thereby creating a "every course is an island—every faculty is his or her own stakeholder" curriculum model. When selecting PBL as the desired pedagogy, educational leaders need support faculty to facilitate them to get on board with its underlying philosophical values to optimize success in using PBL. Curricular goals, course goals, course expectations, and *faculty teaching styles need to be aligned with PBL goals and educational philosophy.*

Alignment may include necessary strategies such as:

- Having the entire faculty as a whole design the curriculum.

- Establishing a departmental policy that no faculty change course expectations, goals, or content except in consultation with the faculty as a whole regarding how the changes will fit with the overall curriculum design.
- Aligning student assignments and tutorial group expectations with the elements of "authentic PBL." For example, if PBL is to be self-directed, then students must be permitted to struggle to identify the learning issues as they emerge from the case, without explicit direction from faculty or tutors. If EBP is a goal of PBL, then expectations for the use of EBP in tutorials along with evaluation of EBP must be included in course syllabi and the evaluation of student performance in tutorials.

2. *Educational leaders and PBL tutors must develop skills and actively work with tutorial groups to create a culture of commitment and inquiry, and develop collaborative partnerships for learning with students.* Unquestionably this requires faculty, PBL tutors, and students to adopt the underlying philosophical values of PBL and make a transition in their respective roles as faculty and students from givers and receivers of information, to self-directedness and creating collaborative learning partnerships. Faculty and students alike must rethink how learning and teaching occurs. Faculty must open themselves up to being wrong and to students' feedback, and students must assume greater self-directedness and responsibility for their own learning.

- Faculty, students, and tutorial facilitators will need orientation to PBL that includes its underlying philosophy as well as implications adopting PBL values have for one's role and how one teaches and learns.

- Tutors will need to create a culture of inquiry, constantly asking students questions, modeling critical thinking, asking students to give a rationale for their conclusions based on research evidence, theory, and sound reasoning. Tutors will need to model critical thinking until students begin to internalize critical thinking themselves in their own research and in questioning each other. Tutors may also need to support individual students to assume a facilitatory role and help the student resist "teaching."
- Tutors may need to model and actively facilitate reflective practice: engage students in peer-and self-evaluation not only to discover gaps in knowledge and skills, but also to discover how one's own feelings, biases, and emotions affect clinical decisions. Tutors will need to demonstrate willingness to listen to students' feedback and make changes when appropriate. Tutors will also need to work with students in self-reflection and goal setting to fill knowledge and skill gaps.
- Faculty tutors may choose to facilitate the tutorial group in a discussion format sooner in the curriculum rather than in the second semester or later. Tutors need to actively facilitate and help structure tutorial groups to engage in discussions. *This is no easy task since individual students have researched* individual topics, prepared handouts on those topics, and have gained a higher level of knowledge on their topic. How they then select the most relevant aspects and engage in a group discussion is challenging and it is the tutor's role to help the tutorial group make that transition. Tutors may need to make certain structural interventions such as suggesting that students "turn over"

their handouts so they cannot refer to them, go through the case and engage in a discussion issue by issue, or clinical question by clinical question. Tutors may also have to assume a more active role in questioning, reiterating the agreed upon structure and bringing the students into a discussion. An unintended impediment to transitioning to a discussion format is the language used to describe the phases of the PBL process. The "reporting out" phase for example, seems to have been uniformly interpreted as minipresentations or lectures however contrary to Barrows's (1985) original intent of creating a team discussion of the relevant case issues. Renaming this phase as the "case discussion" phase may help clarify this.

3. *Educational leaders will need to provide support, ongoing education, and supervision to PBL tutors on PBL facilitation strategies that include academic content, PBL philosophy, serving as metacognitive guides, and managing group process.* Educational leaders will need to provide ongoing supervision to tutors on how to integrate the PBL philosophy into their own role behaviors. Tutors will need support in learning how and when to give structure and information, and when to let the group struggle to find the answers and method themselves. Tutors will also need to learn how to translate statements they may be tempted to make into questions instead. They will also need to find strategies for giving feedback to students when the information they present is inaccurate or inadequate. Translating feedback statements into such questions as, "How do we know that is the case?", "Do we have enough information about this topic to make a clinical decision?", and "Is this information important for us to know?" Educational leaders can also serve as models

themselves as they observe tutors facilitating tutorial groups. Videotaping tutorials for the purpose of supervision is an additional strategy that can actively engage teams of tutors in brainstorming strategies to address issues of group process, serve as metacognitive guides, and model critical thinking.

4. *Educational leaders will need to generate adequate support, resources, and structures to support faculty, tutors', and students' use of EBP.* Immediate access to high quality research databases during tutorials is essential. In this manner, tutorial groups can efficiently answer information questions without delay and then continue the discussion. Educational leaders must also assume responsibility for making sure tutors and faculty know the skills of EBP; are able to conduct efficient and effective searches, select the appropriate research suitable to the case, and evaluate the credibility, validity, and utility of the research. Tutors then can facilitate students in learning to become more efficient in their research by questioning them as to what key words they could use to conduct a search and identify specific databases and sources of information. Learning to be consumers of research, learning the skills of reading, interpreting, and evaluating research, is a skill that appears to be more effectively taught in courses other than the PBL course. Students in both the occupational and physical therapy programs remarked that their augmentative research course taught them how to read and understand research and how to write critically appraised topics (CATs). Students then were able to apply these skills when probing databases for research that applied to their PBL case. PBL courses appear to be the most appropriate to practice and apply EBP, but courses other than the PBL course appear to be the most appropriate place to teach EBP skills.

5. *In the role of developing admission criteria for PBL programs, educational leaders may need to attend to dispositional characteristics of students, particularly self-directedness, diligence, and work ethic.* Dispositional characteristics appear to be highly influential in affecting students' development of critical thinking, EBP, and the role transitions required by the PBL method. However, it is unclear in the literature or through this research, just which dispositions are most important with the exception of self-directedness and work ethic, so this strategy warrants further research prior to implementation of specific admission criteria.

Implications for Future Research

Based on the results of this study, further research into the specific instructional practices, curriculum design features, and student dispositions would be useful in designing PBL curriculum and tutor education strategies. This research was limited to the study of two cases—two PBL programs within one institution. To expand this limited research, several recommendations for future research follow:

1. Occupational and physical therapy students were found to make significant improvements in the development of critical thinking and use of EBP in PBL tutorials in this study. It would be important to know if students made equal gains in their critical thinking and EBP in other contexts, including curriculum where PBL is an augmentative course and in curriculum that use more traditional, lecturebased teaching methods. Do students develop critical thinking and EBP in curriculums that use traditional methods? Are other pedagogical methods equally effective in teaching critical thinking and/or EBP?

2. This research was limited to a small number of participants in one University. It was also limited to two programs that used PBL as the primary pedagogical method in their curriculum. It would be fascinating to replicate this research and compare programmatic groups that used PBL differently; those that use it as the primary pedagogy, those programs that use PBL as an augmentative or capstone course, and those programs that use only more traditional pedagogical methods. Further research could determine if the extent to which PBL is applied in a curriculum is relevant to the development of students' critical thinking.

3. Time was a limiting factor in this study. It would be important to extend data collection over the course of the entire curriculum sequence to broaden our understanding as to when and how much students progress in the development of critical thinking and EBP. Extending data collection and including a pretest of critical thinking at the onset of the program would provide insight as to how much gain students actually made in the PBL curriculum.

4. This research study was limited by the instruments used to measure critical thinking and EBP. Norms for the *CCTST* are for graduates of four-year colleges and universities, not for graduate students or graduate health care education students. In the midst of data collection for this study, the Faciones published a new critical-thinking instrument, *The Health Sciences Reasoning Test* (Facione & Facione, 2006), developed specifically for graduate health-care education students. It would be important to replicate this study using this new more-appropriate instrument. Additionally, there is no valid or reliable instrument that evaluates EBP. The researcher adapted Straus et al.'s (2005) *Sel-Evaluation of EBP* with a Likert scale.

Neither Straus et al.'s (2005) nor the researcher's instruments have been validated with psychometric research. The researcher received feedback from students and tutors that the language of the *Self-Evaluation of EBP* was sometimes difficult to glean the meaning and that some students interpreted "clinical decisions" literally and therefore did not answer those questions because they were "not yet practicing" in a clinical setting. Future research would include establishing reliability and validity of an instrument to assess students' use of evidence-based practices.

5. This research found that the tutor's modeling of critical thinking emerged as a critical instructional practice which students then internalized and adopted as their own. While this has implications for the kind of education and supervision tutors receive, researchers may look into this further. Most empirical studies have examined the effect of a tutor's clinical expertise versus group process expertise. This study's findings identified the tutor's skill in modeling critical thinking as imperative to the students' development of critical thinking. Researchers may want to study this skill in particular for its effect on students' critical thinking with a larger sample size of tutors and students.

6. A tutorial group culture of commitment also emerged as a major finding of this study. Students' dispositional characteristics, a group format of discussion, and the tutor's relationship with students surfaced as important to the creation of this culture. Researchers may want to investigate students' dispositional characteristics to identify which are most compelling to the development of critical thinking and success in PBL. The findings of such a study may ultimately influence admissions criteria into PBL curricula. Additionally, researchers may want to fully explore the

dispositional and philosophical values of tutors to determine if they affect the tutor's ability to engage in collaborative partnerships with students. Researchers may also want to study the interaction between tutors and students to determine which group processes and structures help the group transition to a discussion format.

7. Curriculum design and course expectations emerged as key to the students' development of evidence-based practices in particular. It was found that students in both the occupational and physical therapy programs learned EBP skills in their augmentative research courses, but practiced application of EBP in PBL tutorials. The occupational therapy students were found to routinely use EBP in tutorials whereas the physical therapy students did not; and, this was largely due to PBL course expectations. The researcher is also aware that several occupational and physical therapy curriculums that do not use PBL require specific EBP courses for their students. An interesting question is whether or not students in PBL curriculum who have EBP expectations for tutorials as compared to students in a lecturebased EBP course, use EBP when solving case problems. An additional research question is whether or not students transfer the use of EBP to their clinical practice once they get into fieldwork (supervised clinical practice). A third question is whether or not the physical therapy students begin to routinely use EBP in their final year as is expected of them in their curriculum.

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APPENDIX A

INTERVIEW GUIDE

Interview Guide

Program: OT PT
Name:
Gender:
Race:
Age:
Date:
Facilitator:

You were selected to interview because of the change in your critical thinking and or use of evidence-based practices as indicated by the CCTST and or the EBP self-evaluation. I am interested in finding out what your perceptions are about what you think brought about the change.

What happened in your tutorial group that may have contributed to your use of CT?

What happened in your tutorial group that may have contributed to your use of EBP?

What happened outside tutorial that contributed to your use of CT and EBP?

What specifically did your facilitator do that contributed to your CT?

What specifically did your facilitator do that contributed to your EBP?

What did you do that contributed to changes in your CT and EBP?

APPENDIX B

SELF-EVALUATION OF EVIDENCE-BASED PRACTICE

A Self-Evaluation in Evidence Based Practice

Name:
Date:
Program: OT PT
Facilitator:

Ask yourself the following questions and rate the degree to which you are doing these things at the present time. The rating is meant to be a "snapshot in time" and seeks your own estimation regarding how and what you are doing regarding evidence-based practice (EBP) at this present moment.

Please include comments and examples in each category.

Scale						
Rarely About 25% of the time. I am not very good at this.	About 25%50% of the time. I try but have a ways to go at this.	About 50% of the time. I am soso at this.	Some of the time. About 60%75% of the time. I am fairly good at this.	Most of the time. About 75%85% of the time. I am good at this.	Almost always. About 85% of the time. I am very strong at this.	Always. Nearly 100% of the time. I excel at this.
1	2	3	4	5	6	7

Asking answerable questions

Am I asking clinical questions?						
1	2	3	4	5	6	7
Am I asking 2part questions about "background" knowledge? (what, where, when, how, why questions about an aspect of the condition or issue of interest)						
1	2	3	4	5	6	7
Am I asking 3 or 4 part "foreground" or PICO questions about diagnosis, management, prognosis and outcomes? (question includes patient and or problem; the main intervention, or assessment procedure; comparison to another intervention, or assessment procedure if relevant; clinical outcomes of interest to the case)						
1	2	3	4	5	6	7
Am I using a "map" or concept map to identify my knowledge gaps and articulate questions?						
1	2	3	4	5	6	7
Can I get myself "unstuck" when asking questions and formulating learning issues?						
1	2	3	4	5	6	7
Do I have a working method to save my questions for later answering?						
1	2	3	4	5	6	7
Comments & examples:						

Scale						
Rarely About 25% of the time. I am not very good at this.	About 25%50% of the time. I try but have a ways to go at this.	About 50% of the time. I am soso at this.	Some of the time. About 60%75% of the time. I am fairly good at this.	Most of the time. About 75%85% of the time. I am good at this.	Almost always. About 85% of the time. I am very strong at this.	Always. Nearly 100% of the time. I excel at this.
1	2	3	4	5	6	7

Finding the best external evidence.

Am I searching at all?						
1	2	3	4	5	6	7
Do I know the best sources of current evidence for my clinical discipline?						
1	2	3	4	5	6	7
Have I achieved immediate access to searching hardware, software, research databases and the best current evidence for my clinical discipline?						
1	2	3	4	5	6	7
Am I finding useful external evidence from a widening array of sources?						
1	2	3	4	5	6	7
Am I becoming more efficient in my searching?						
1	2	3	4	5	6	7
Am I using headings, thesaurus, limiters, and text when searching the research databases?						
1	2	3	4	5	6	7
How do my searches compare with those of research librarians or other respected colleagues who have a passion for providing best current patient care?						
1	2	3	4	5	6	7
Comments & examples:						

Critical appraisal of evidence for its validity and potential usefulness

Am I critically appraising external evidence at all?						
1	2	3	4	5	6	7
Am I creating and articulating sound criteria to use as a critical appraisal guide?						
1	2	3	4	5	6	7
Are the critical appraisal guides becoming easier for me to apply?						
1	2	3	4	5	6	7
Am I becoming more accurate and efficient in applying some of the critical appraisal measures?						
1	2	3	4	5	6	7
Am I creating critical appraisal summaries or CATs for the evidence I find?						

1	2	3	4	5	6	7
Comments & examples:						
			Scale			
Rarely About 25% of the time. I am not very good at this.	About 25%50% of the time. I try but have a ways to go at this.	About 50% of the time. I am soso at this.	Some of the time. About 60%75% of the time. I am fairly good at this.	Most of the time. About 75%85% of the time. I am good at this.	Almost always. About 85% of the time. I am very strong at this.	Always. Nearly 100% of the time. I excel at this.
1	2	3	4	5	6	7

Integrating evidence and patient's values, goals, perspectives, context and evaluation

Am I integrating my critical appraisals into my practice at all?						
1	2	3	4	5	6	7
Am I becoming more accurate and efficient in adjusting some of the critical appraisal measures to fit my individual patients?						
1	2	3	4	5	6	7
Can I explain (and resolve) disagreements about management decisions in terms of this integration?						
1	2	3	4	5	6	7
Do I find evidence appropriate to my patients and the conditions they have, their functional abilities and limitations, contexts they are in, and values, goals and preferences they aspire to?						
1	2	3	4	5	6	7
Comments & examples:						

Scale						
Rarely About 25% of the time. I am not very good at this.	About 25%50% of the time. I try but have a ways to go at this.	About 50% of the time. I am soso at this.	Some of the time. About 60%75% of the time. I am fairly good at this.	Most of the time. About 75%85% of the time. I am good at this.	Almost always. About 85% of the time. I am very strong at this.	Always. Nearly 100% of the time. I excel at this.
1	2	3	4	5	6	7

Is my practice improving?

When new evidence suggests a change in practice, am I identifying barriers to this change?						
1	2	3	4	5	6	7
Am I identifying ways to overcome them?						
1	2	3	4	5	6	7
Have I carried out any check or pilot, such as audits of my diagnostic, therapeutic, or other EBP performance to implement measure the change?						
1	2	3	4	5	6	7
Do I check if changes have occurred and identified why or why not?						
1	2	3	4	5	6	7
If the changes worked, do I systematize the plan? If the changes have not worked, do I reformulate a plan?						
1	2	3	4	5	6	7
Can I explain (and resolve) disagreements about management decisions in terms of this integration?						
1	2	3	4	5	6	7
Comments & examples:						

APPENDIX C

SELF-EVALUATION OF TEACHING EVIDENCE-BASED PRACTICE

A Self-Evaluation in Teaching Evidence Based Practice

Facilitator's Name:
Date:
Program: *OT* *PT*

Ask yourself the following questions and rate the degree to which you are doing these things at the present time. The rating is meant to be a "snapshot in time" and seeks your own estimation regarding how and what you are doing regarding teaching evidence-based practice (EBP) in your PBL tutorial group now.

Please include comments and examples in each category.

Scale						
Rarely About 25% of the time. I am not very good at this.	About 25%50% of the time. I try but have a ways to go at this.	About 50% of the time. I am soso at this.	Some of the time. About 60%75% of the time. I am fairly good at this.	Most of the time. About 75%85% of the time. I am good at this.	Almost always. About 85% of the time. I am very strong at this.	Always. Nearly 100% of the time. I excel at this.
1	2	3	4	5	6	7

Teaching the asking of answerable clinical questions

I challenge students to ask clinical questions (questions about the clinical problem & all its elements)?						
1	2	3	4	5	6	7
I facilitate students to ask 2part questions about "background" knowledge? (what, where, when, how, and why questions about an aspect of the condition or issue of interest)						
1	2	3	4	5	6	7
I facilitate student to ask 3 or 4 part "foreground" or PICO questions about diagnosis, management, prognosis and outcomes? (the PICO question includes patient or problem; the main intervention, or assessment procedure; comparison to another intervention, or assessment procedure if relevant; and clinical outcomes of interest to the case)						
1	2	3	4	5	6	7
I facilitate students to use a "map" or concept map to identify my knowledge gaps and articulate questions?						
1	2	3	4	5	6	7
I facilitate students to get "unstuck" when asking questions and formulating learning issues?						
1	2	3	4	5	6	7
I have a working method to facilitate students to save questions for later answering?						
1	2	3	4	5	6	7

Comments & examples:						
Scale						
Rarely About 25% of the time. I am not very good at this.	About 25%50% of the time. I try but have a ways to go at this.	About 50% of the time. I am soso at this.	Some of the time. About 60%75% of the time. I am fairly good at this.	Most of the time. About 75%85% of the time. I am good at this.	Almost always. About 85% of the time. I am very strong at this.	Always. Nearly 100% of the time. I excel at this.
1	2	3	4	5	6	7

Teaching students how to find external evidence

I make sure my students know how and where to find the best external evidence to answer questions.						
1	2	3	4	5	6	7
I know the best sources of current evidence for my clinical discipline?						
1	2	3	4	5	6	7
I facilitate students to find useful external evidence from a widening array of sources?						
1	2	3	4	5	6	7
I facilitate students in becoming more efficient in searching by using headings, thesaurus, limiters, and text when searching the research databases??						
1	2	3	4	5	6	7
How do my students' searches compare with those of research librarians or other respected colleagues who have a passion for providing best current patient care?						
1	2	3	4	5	6	7
Comments & examples:						

Teaching critical appraisal of information and research evidence

I facilitate students to critically appraise information and research evidence they find.						
1	2	3	4	5	6	7
I facilitate students to create and articulate sound criteria to use as a critical appraisal guide?						
1	2	3	4	5	6	7
The critical appraisal guides are becoming easier for students to apply?						
1	2	3	4	5	6	7
I model the critical appraisal of information and research evidence.						
1	2	3	4	5	6	7
I facilitate students to create critical appraisal summaries or CATs for the evidence they find.						
1	2	3	4	5	6	7
Comments & examples:						

Scale						
Rarely About 25% of the time. I am not very good at this.	About 25%50% of the time. I try but have a ways to go at this.	About 50% of the time. I am soso at this.	Some of the time. About 60%75% of the time. I am fairly good at this.	Most of the time. About 75%85% of the time. I am good at this.	Almost always. About 85% of the time. I am very strong at this.	Always. Nearly 100% of the time. I excel at this.
1	2	3	4	5	6	7

Teaching and modeling the integration of best research evidence with my clinical expertise and the patient's values, goals, perspectives, and context.

I model the integration of critical appraisal of information and research into my practice.						
1	2	3	4	5	6	7
I am increasingly more accurate and efficient in adjusting some of the critical appraisal measures to fit my individual patients.						
1	2	3	4	5	6	7
I explain (and resolve) disagreements about clinical decisions in terms of the integration of research and my particular patient's functional abilities and limitations, contexts they live in, values, goals, and preferences.						
1	2	3	4	5	6	7
I find evidence appropriate to my patients and the conditions, functional abilities and limitations, contexts they live in, values, goals, and preferences they have.						
1	2	3	4	5	6	7
Comments & examples:						

Evaluating the effectiveness of my teaching

When new evidence suggests a change in practice or teaching, I identify barriers to this change?						
1	2	3	4	5	6	7
I identify ways to overcome these barriers.						
1	2	3	4	5	6	7
I model and facilitate students to develop a plan to overcome barriers to change and to check out if changes have occurred as a result of their plan.						
1	2	3	4	5	6	7
I model self-reflection and self-evaluation.						
1	2	3	4	5	6	7
I facilitate group feedback.						
1	2	3	4	5	6	7
Comments & examples:						

APPENDIX D

OCCUPATIONAL THERAPY PROBLEMBASED LEARNING COURSE SYLLABUS

COURSE SUMMARY SHEET 1998 STANDARDS

FORM B

Course Number/Name: OT514: Biopsychosocial Maturation and Occupational Therapy Assessment and Intervention II: Late Adolescence, Young Adult, Middle Adult

OT Course Level: **Undergraduate:** **Yr 1** ___ **Yr 2** ___ **Yr 3** ___ **Yr 4**
Graduate: **Yr 1** _x_ **Yr 2** ___ **Yr 3** ___ **Yr 4** ___ **Yr 5**

OTA Course Level: **Yr 1** _x_ **Yr 2**

Credits: 11 **Clock Hours Per Week in: Lecture** 2 **Lab** 6
FWI 68
Tutorial: 6
Average faculty/student ratio: Lecture: 1: 35/Lab: 1: 15/Tutorial: 1: 8

Faculty member(s) responsible: xxxxxxxxxxxxxxxxxxxxxxxx
(Cite as many as necessary. Only required for courses in the major.)

Introductory statement:
This form must be completed for each course in the curriculum. The course syllabus used by the program should be attached. Provide a narrative response for those questions not clearly described in the course syllabus.

COURSE DESCRIPTION:
This course examines adult typical and atypical development, diseases, disorders, conditions and traumas. The typical and atypical development and disease processes that can occur within human systems in this stage are studied as they impact on functioning and purposeful occupations. Labs focus on the application of musculoskeletal, biomechanical, splinting, sensorymotor, social, psychological and cognitive principles necessary for successful adaptation, function, and meaning of occupation in the contexts of the adolescent's and adult's life. In addition, this course reviews and examines the various OT frames of reference as related to assessment and intervention techniques used to assess and intervene in the conditions, disease processes and disabilities that are prevalent during later adolescence, young adulthood, and middle adulthood. Application of various OT frames of reference, which address all types of intervention from the assessment process through discharge planning and followup, are reviewed and practiced in lab and Level I Fieldwork.

RELATION TO THE CURRICULUM DESIGN:
This course provides students with the foundational, assessment, and intervention knowledge they need to evaluate and intervene as an occupational therapist with

adolescents and adults. Students will learn broad foundational concepts that they can apply across diagnoses and populations and will learn the importance of a comprehensive and holistic approach to basic human health. Students will learn specific and general assessments and interventions they can apply to a wide range of individuals in a variety of settings. Course content will be addressed in the context of tutorials, self-directed tutorials, labs, seminars, and lectures. In addition, students will participate in at least two joint labs with Housatonic Community College occupational therapy assistant students. Finally, the course will emphasize the philosophy of communitycentered assessment and intervention, the necessity of clientcentered, holistic care, and the importance of the health continuum and its relation to health promotion.

SEE ATTACHED SYLLABUS FOR: Course Objectives, Teaching/Learning Methods, Required Texts, Recommended Texts, Assignments and Grading, Topical Outline, Class Policies.

[Faith Based] University

GRADUATE PROGRAM IN OCCUPATIONAL THERAPY

OT 514: Biopsychosocial Maturation and Occupational Therapy Assessment and Intervention in Late Adolescence, Young Adult, Middle Adult

Spring, 2006

COURSE SYLLABUS

Credit Hours:	11
Course Instructor:	xxxxxxxxxxxxxxxxxx
Email:	xxxxxxxxxxxxxxxxxx
Office Phone:	xxxxxxxxxxxxxxxxxx
Office Hours:	By appointment
Seminar/Lecture:	xxxxxxxxxx
Lab Instructor(s):	xxxxxxxxxx
	xxxxxxxxxx
Tutorial Instructor(s):	xxxxxxxxxx
Lecture/Seminar:	Monday, Tuesday, & Thursday: 9: 0010: 00

Lab:	Tuesday & Thursday: 10: 0012: 00
PBL Tutorial:	Monday & Thursday: 2: 30 5: 30
Self-Directed Tutorial:	Thursday: 1: 002: 30; Friday: 9: 001: 00
Level I Fieldwork:	Wednesday

COURSE DESCRIPTION

OT 514 focuses on the foundations and principles that serve as the scientific and theoretical basis for occupational therapy assessment and intervention, as well as the development of skills in adult assessment and intervention. Students will utilize skills in critical analysis and clinical decision-making in the integration and application of foundational knowledge, principles of clientcentered practice, and concepts of occupation and occupational therapy frames of reference in the acquisition and application of occupational therapy skills utilized in adult practice. Students will participate in one day of Level I Fieldwork for students to further develop and practice their skills in clinical contexts and typical contexts appropriate to adolescents and adults.

RELATION TO CURRICULUM DESIGN

OT 514 is designed to provide students with multiple learning opportunities in an integrated format in order to facilitate the students' synthesis of a broad range of scientific and theoretical models with the skills used in adolescent and adult assessment and intervention. This is done to more accurately reflect real practice, where the systems and contexts of adults and adolescents are not separated from each other or from the occupations in which they engage, the meaning of these occupations, or the contexts of their lives. Utilizing critical analysis and clinical reasoning, students will practice the conceptualization, interpretation and synthesis of foundational theories and principles in the biological, psychosocial, medical sciences with the concepts of occupational science and spirituality and meaning of occupation. Students will also practice the application and synthesis of these theories and principles to the skills used throughout the processes of adolescent and adult occupational therapy assessment and intervention.

COURSE OBJECTIVES

On completion of this course, the student will be able to:	**ACOTE Standard**
1. Impart and receive information to and from peers and instructor during labs, seminars, lectures and tutorial.	B.5.8
2. 2. Interact with peers and instructor through written handouts, oral presentations and nonverbal expressions in a manner reflecting professional behaviors.	B.5.9 B.1.1
3. Analyze the occupations, tasks and activities of tutorial cases using occupational performance areas, components, and contexts.	B.2.8

4. Apply theories, models and frames of reference appropriate to the tutorial cases to develop evaluation and intervention plans and examine the meaningful occupations of the case. B.3.5

5. Use nonstandardized screening tools to determine the need for OT intervention, including functional performance interviews, pain screenings, and disability screenings. B.4.1

6. Select case specific assessment tools based on the needs, values, and goals of the case. B.4.2

7. Use appropriate procedures and protocols when administering assessments such as the Jebson, Moberg, SCATBI, and ACL. B.4.3

8. Analyze and interpret evaluation information presented in tutorial cases in relation to uniform terminology, relevant theoretical frameworks, models of practice and frames of reference. B.4.7. B.5.1

9. Use safety precautions during screening, evaluation, and therapeutic intervention process. B.4.8 B.5.13

10. Identify when tutorial cases or lab cases should be referred to another discipline, practitioner, and specialist for evaluation, consultation, and interventions beyond the scope of OT practice or the competency of the individual practitioner. B.4.9 B.5.15

11. Document OT evaluation reports, intervention plans, long term and short term goals for professional accountability and standards for reimbursement. B.4.10 B.5.20

12. Develop occupationally based intervention plans and strategies for older adolescents. B.5.2

13. Recommend evidence based effective therapeutic interventions related to the performance areas, components, and contexts as outlined in tutorial and lab cases and examples. B.5.3

14. Suggest occupations and purposeful activities that relate to the intervention goals of the tutorial case. B.5.4

15. Develop and promote appropriate home and community programs for tutorial cases based on the needs and goals of each case. B.5.6

16. Present plans to educate client/family/significant others in the facilitation of occupational performance, prevention, health maintenance, and safety. B.5.7

17. Describe and use therapeutic adaptation with occupations pertinent to the B.5.10

needs of the tutorial cases and lab examples.

18. Modify tasks related to the performance areas and components of the cases presented in tutorial and lab. B.5.4

19. Understand the need for and use/teach compensatory strategies to facilitate the performance of desired occupations among late adolescents, young adults, and middle adults. B.2.10 B.5.12

20. Develop skills in collaborating with OTA's on the therapeutic assessments and interventions. B.5.14

21. Reevaluate the effect of OT interventions and the need for continued and/or modified intervention plans, goals and strategies. B.5.16

22. Organize, collect, and analyze data in systematic manner for evaluation of personal performance and competencies in lab. B.5.18

23. Students will organize and clean laboratories and equipment. B.7.10

24. Document evaluation reports, intervention plans and laboratory activities according to the style dictated by the tutorial case client and regulatory agency and laboratory instructor. B.7.11

25. Assess, hypothesize, and analyze the occupational performance and performance component functioning of adolescents and adults using knowledge of development and life contexts of family and community. B.1.7 B.2.3

26. Research and use informational resources for class handouts, presentations, and assignments. B.8.3

On completion of the course, the student will demonstrate knowledge, understanding, and appreciation of:

27. Appreciate the contributions of ethnic, cultural, social and economic factors to the health behaviors of the tutorial case. B.1.7

28. Life balance for the achievement of health and wellness among late adolescents, young adults, and middle adults. B.2.5

29. The role of the occupation in promotion of health and prevention of diseases and disabilities experienced by late adolescents, young and middle adults. B.2.6

30. The following models and frames of reference and how they are used in OT: biomechanical, rehabilitative, holistic, occupational adaptation, ecology of human performance, cognitivebehavioral, multicontextual cognitive, and B.3.2 B.3.3

cognitive disabilities

31. The importance of cooperation with the OTA during the OT processes of screening, assessment, and intervention. B.4.4

32. Personal responsibility for planning ongoing professional development and competencies regarding continued development of research on this population, prevalent conditions and interventions. B.9.4

33. Professional responsibilities related to liability, competency, and professional guidelines for practice under current models of service provision. B.9.5 B.9.6

34. The roles of an occupational therapist may fulfill (clinical practitioner, educator, and researcher) when working with adults and late adolescents. B.9.7

35. Advocating for the rights and entitlements of the individuals we serve. B.9.13

On completion of this course, the student will:

36. Integrate the influence of social and cultural conditions and ethical contexts on occupational and health behaviors. B.1.8

37. The individual's perception of quality of life, wellbeing, and occupation in relation to their health behaviors. B.2.9

38. Students will demonstrate professional behaviors and attitudes appropriate to the practice of occupational therapy. B.9.1 B.9.6

TEACHING/LEARNING METHODS

Problembased Learning (PBL) will be the primary methodology for learning in this course. PBL is a specific educational model with a prescribed protocol for the attainment of knowledge, skills, and adoption of professional attitudes. PBL differs from other educational models in that it is student centered and focuses on the student's learning rather than on the instructor's teaching. To best meet these objectives, PBL utilizes a small group format called "tutorial" which are facilitated by a faculty "tutorial facilitator". The facilitator's role is to facilitate the process of learning rather than convey knowledge. The facilitator is responsible for establishing a structure and climate by which students determine what they need to know and how to best learn it.

Course content is presented in the context of modules. The content modules for this semester are as follows:

Module One: Autoimmune and Immunological Disorders
Module Two: Musculoskeletal Disorders
Module Three: Neurological/Neuromuscular Disorders

Comorbid factors, contexts, service delivery models, sociocultural, diversity, and legal/policy factors will be interwoven into the cases offered in each module.

PBL TUTORIAL

Tutorial groups consist of 48 students and a tutorial facilitator. Sessions focus on carefully developed clinical cases related to a module topic area. The facilitator assists students to manage group dynamics and to direct attention to the process of inquiry and the relevant aspects of the case. Students are responsible for planning their session time, including time for organizing the session, for case review, for planning methods and criteria for obtaining information, and for evaluating the session. Facilitators are responsible for facilitating learning, assisting students with relevancy, and facilitating the process of inquiry. The facilitator does not ordinarily provide information, but may refer students to general learning resources.

PBL tutorial groups meet twice weekly for three hour sessions. Assignment to tutorial groups each semester is made by faculty members in order to provide for maximum diversity of student experiential and academic backgrounds within each group. Groupings are not changed within a given semester. The intense interpersonal relationships among members of a tutorial group are similar to those among members of the health care team. Health care providers have limited opportunities to change team membership, and must learn to influence the desired changes in behavior of self or others to achieve group goals. The tutorial group provides practice in this real life process of adjustment.

During PBL tutorial sessions, case problems will be used as the vehicles for the PBL process. In PBL, cases are not used to illustrate previously provided teacher content, rather, students carry out self-directed learning and clinical reasoning and decision-making in the same manner and sequence, which is required in clinical practice. The case is the vehicle for learning knowledge, skills and processes through critical analysis and synthesis of information, group discussion and teamwork, and application of what was learned to clinical problems and clinical decisions.

Each case within a given module will include learning objectives about the module topic. Students must complete the prescribed number of cases in each module. Each case is carefully designed, with content, process, skill, and attitudinallearning issues embedded within it. Students will work through the case using a prescribed sequence of inquiry. Students will list unfamiliar and important terms and concepts, list the

facts known about the case, formulate hypotheses, state a rationale for their hypotheses, list the learning issues and objectives of the case, and determine who and how those objectives will be addressed. Cases may consist of two or more parts, and students may have to repeat this procedure in light of new information presented and new information learned.

Students should anticipate spending an average of 68 hours per week outside scheduled tutorial time on their tutorial inquiry.

SELF-DIRECTED TUTORIAL

Time for independent research and analysis of learning content is scheduled into your schedule for a total of 6 hours/week. The intent of this block of time is to allow individual or group inquiry into the learning topic for that week. It is expected that students will use this time for independent research in the library or online. Students are also encouraged to use other resources during this time, including the cadaver lab, the computer lab, the anatomical models, the OT Assessment Library, available Assistive Technology and other available equipment within the department. The time can also be used for students to meet with faculty or clinicians in order to facilitate the learning of the objectives generated during the PBL inquiry process. Students may also request specific faculty to serve as a resource for specific learning issues. In addition, faculty may use self-directed tutorials for the administration of short exams and quizzes, to conduct special workshops, or to reschedule labs, seminars, and tutorials in the event of a scheduling conflict. The self-directed tutorial sessions are essential to the PBL methodology used throughout the curriculum.

This time is not to be scheduled for employment, free time, personal commitments, etc., or to forfeit childcare arrangements. This time also should not be used to complete other coursework.

SEMINAR

Seminars presented in the classroom setting, using lecture discussion, class participation and interactive format. The intent of seminars is to engage the students in learning, processing, and discussing topics. Additionally, seminars provide a forum for students to develop their critical thinking skills through the presentation of divergent concepts and the process of comparing and contrasting them.

LECTURE

OT faculty directs lectures; however, in keeping with a graduate curriculum emphasizing independent learning, these sessions provide opportunity for active faculty/student discourse. Faculty or students may initiate lecture topics, though faculty will ensure integration with appropriate labs, tutorials, and seminars. Lecture serves the purpose of delivering information and facilitating discussion about a topic.

LAB

Sessions are directed by occupational therapy faculty and students and focus on topics related to appropriate lecture, seminar or tutorial module. Technical performance of evaluation, treatment, and communication skills is enriched with exploration of issues involved in clinical decision-making such as the validity and reliability derived from patient evaluation procedures, costs, and risks of procedures, selecting, staging, and sequencing procedures, and medical record documentation.

Student evaluations are based on class participation, records kept by laboratory instructor, assignments and Observation of Clinical Skills Evaluation.

LEVEL I FIELDWORK LATE ADOLESCENCE/ADULT

Level I FW involves observation and interaction with late adolescence/adults in a variety of settings. It includes structured assignments that enable occupational therapy students to reflect on late adolescence/adults diagnosed with disabilities as they engage in occupational performance. Each student will be assigned a FW setting and supervisor. Supervisor possibilities may include but are not limited to occupational therapists, physical therapists, social workers, and psychologists. Students are expected to follow the guidelines listed in the Level II Fieldwork information sheet of the *Fieldwork Manual* for professional behaviors, dress code, conduct, and confidentiality. In the event of an illness or emergency necessitating absence/leaving early, students must notify the FW supervisor and FW coordinator as soon as possible. Students are responsible for making up the time they miss in Level I FW. Students must notify the FW coordinator and course instructor of the makeup arrangements once they have been made with the FW supervisor.

REQUIRED TEXTS

Behrens, B.J., Michlovitz, B. J. (2006). *Physical Agents: Theory and Practice,* (2nd ed). Philadelphia: F. A. Davis.

Brotzman, S. B., Wilk, K. E. (2003). *Clinical Orthopaedic Rehabilitation,* (2nd ed). Philadelphia: Mosby.

Clarkson, H.M. (1999). *Musculoskeletal Assessment: Joint range of motion And manual muscle strength.* Philadelphia: Lippincott Williams Wilkins

Jacobs, ML., Austin, N. (2003). *Splinting the hand and upper extremity: Principles and Process.* Philadelphia: Lippincott Williams & Wilkins

Katz, N. (2005). *Cognition & occupation across the life span: Models for Intervention in occupational therapy,* (2nd ed.). Bethesda, MD: AOTA Press.

Muscolino, J. E. (2002). *The muscular system manual: Skeletal muscles of the human body.* Redding, Connecticut: JEM Publications.

Nolan, M. (1996). *Introduction to the neurologic examination.* Philadelphia: F.A.Davis.

Pedretti, L. (2002). *Occupational Therapy skills for physical dysfunction,* (4th ed.). Philadelphia: Mosby.

Sames, K. M. (2005). *Documenting occupational therapy practice.* Upper Saddle River, NJ: Pearson Prentice Hall.

Spaulding, S. J. (2005). *Meaningful Motion: Biomechanics for occupational therapists.* New York: Elsevier Churchill Livingstone.

Zoltan, B. (1996). *Vision, perception, and cognition: A manual for the Evaluation and treatment of the neurologically impaired adult,* (3rd ed.). Thorofare, NJ: Slack.

REFERENCE TEXTS

Hersch, G.I., Lamport, N.K., Coffey, M.S. (2005). *Activity analysis: Application to Occupation, 5th ed.*: Thorofare, NJ: Slack.

Trombly, C., Radomski, M. (2002). *Occupational therapy for physical dysfunction,* (5th ed.). Philadelphia: Lippincott Williams & Wilkins.

Umphred, D. (1995). *Neurological rehabilitation, (3rd ed.).* Philadelphia: Mosby.

COURSE POLICIES

Professional behaviors and attitudes are important to students' professional development; therefore, quantity and quality of preparation and also participation comprise a major portion of the student's final grade.

STUDENT EXPECTATIONS FOR THIS COURSE

1. Regular attendance is required.
   - You will be allowed one absence from each portion of the course without penalty, provided that you have good cause for the absence.
   - Additional absences will need to be made up in some manner, determined in collaboration with the primary faculty for that portion of the course.

2. Punctuality is required
   - It is expected that all students will be in the assigned room, ready to begin at the scheduled time.
   - Lateness of more than 15 minutes for a lab, seminar, or PBL session will be considered an absence.

- Lateness of more than 10 minutes for Seminar. Lecture or activity lab will be considered an absence.
- Courses have been scheduled slightly later than typical in the morning to allow for traffic difficulties often encountered. Please plan accordingly to ensure you are on time.

3. Assignments are expected to be turned in on time

- Late assignments must be communicated in advance to the instructor in order for them to be accepted.
- Late assignments communicated to the instructor will be accepted but will result in grade reduction. Each day the assignment is late will result in the reduction of the final grade by one portion of a letter grade.
- Late assignments without communication will not be accepted and will be given a 0.
- PBL handouts must be printed and ready to turn in at the beginning of PBL. Please do not expect to print your handouts right before PBL. If there are printer malfunctions or computer glitches you will then not be able to provide handouts for your group. Therefore you must have your handouts prepared well in advance. Any instances of late handouts (those that are not ready at the beginning of PBL) will be documented and it will be reflected in your PBL portion of your grade.

4. Students are expected to have completed assigned readings prior to lab, seminar, lecture and PBL sessions.

5. Students are expected to bring to class appropriate reference materials and information relevant to the days topic to their PBL sessions.

6. Students are expected to research and review specific information before class to apply to their daily learning session and subsequent examinations.

7. Students are responsible for the proper maintenance of the laboratories, equipment and supplies.

8. Students are expected to demonstrate professional behaviors and communication throughout this course. These behaviors will be outlined in the orientation portion of the program and will be reviewed at the beginning of the course.

9. There will be no opportunities to retake failed exams or redo failed assignments. If a student is unsure about an assignment, it is up to that student to see the instructor

and clarify the requirements. If a student feels he or she is unable to take an exam and perform to his or her ability due to circumstances out of his or her control (i.e. severe illness, family emergency), he or she must speak with the instructor beforehand to discuss alternative arrangements. There is no guarantee that alternatives will be provided but if circumstances warrant it, every attempt will be made to do so.

10. The instructor expects honesty and integrity from all students regarding their submitted work. Any work submitted as one's own, without appropriate quoting and citing, or with apparent plagiarism, will be cause for recommendation to the Dean for student probation. A second infraction may be cause for dismissal from the program. Students are expected to follow the APA format for all citations. Information taken from the web MUST be properly cited and quoted. It is up to the student to be familiar with proper methods of citing, paraphrasing and quoting. (See below for more information).

ACADEMIC HONESTY AND INTEGRITY

One of our purposes in the occupational therapy program, besides educating you about occupational therapy, is your development as a person and a professional. One aspect of your development includes learning to practice ethically and honestly. Here in the program, as will be the case in practice, we expect the utmost performance from our students in terms of their ethics and integrity.

We expect you to take responsibility for your education, by completing required work on your own. To be very straightforward and clear, we mean you will not plagiarize or cheat.

There are two kinds of plagiarism that might occur, intentional or unintentional. Intentional plagiarism means you know that the work you are turning in is not your *own, such as using a paper obtained from someone else as your own or working as a* group and turning in very similar work as individual work. Another example of intentional plagiarism is cutting and pasting together work from several sources, none of which was written by you. I will treat any case of intentional plagiarism by referring the student to the professional performance committee (PPC). The PPC may then make a recommendation to the Dean that the student be placed on academic probation. A failing grade will be given on whichever assignment or exam in which the plagiarism occurred. A second occurrence will result in a failing grade for the course which usually results in dismissal from the program.

There are also cases of unintentional plagiarism when students do not properly cite or reference their work because they are unaware of proper methods. You are required to obtain the APA manual and use it as your guide. If you are unsure how to cite *material, please err on the side of caution. Briefly, any material used word for word* must be quoted. Paraphrasing requires more than merely changing a word here or there. Paraphrased material must still be cited. Quoted material must include the citation and the page number where the quote was obtained. If you have any

questions please ask as it is your responsibility to ensure that I do not find any cases of plagiarism in your work. I will be unable to determine whether or not plagiarism is intentional or unintentional, therefore, all instances will be treated the same way.

ASSIGMENTS AND GRADING
Tutorial=50%
Evaluation Reports/Intervention Plans=25%
Final Tutorial Evaluation=50%
Cumulative Final Exam=25%

Lab=25%
Activity project with Activity Analysis=25%
OSCE 1=25%
OSCE 2=25%
OSCE 3=25%

Lecture=15%
Anatomy Midterm Exam=50%
Presentation=50%

Fieldwork=10%
Assignments=50%
Fieldwork Evaluation=50%

Class Participation=borderline may increase or decrease a point

TUTORIAL ASSIGNMENTS/EVALUATION/EXAM

EVALUATION REPORTS AND INTERVENTION PLANS

Evaluation Reports and intervention plans will be due following the completion of each case. Evaluation Reports and Intervention Plans are designed to assess the student's ability to integrate occupational therapy assessment and intervention theory with practice. For the intervention plans it is recommended that students use the last self-directed tutorial of each module to plan different aspects of practice such as assessment plans, interpretation of assessment data, evaluation summaries, goals and treatment activity plans. Evaluation reports essentially will be an integration of the subjective and objective data presented in the case into an evaluation format, including long and shortterm goals. For each case, students will write EITHER an evaluation report or an intervention plan. These will be submitted via Blackboard Drop Box.

FINAL TUTORIAL EVALUATION

Student evaluations are conducted informally for each student several times over the semester. This includes input from each tutorial group member and from the faculty tutor. Written tutorial evaluations are completed by the tutorial group leader for each student at final and constitute the tutorial grade. Selfassessment by each student is expected. Peer and selfassessments will be considered the final tutorial evaluations although the tutor and course instructor will determine the final tutorial grade. Thresholds for passing tutorials will be determined by the Occupational Therapy faculty. The threshold for passing tutorials will be raised each semester as students are expected to develop their inquiry and group participation meet ever increasing expectations as they progress through the curriculum.

A student who does not meet the passing criteria for tutorial (regardless of course grades) will be referred to the Professional Performance Committee for review. The Committee will review the student's overall record and make its recombination regarding continuation in the Program.

FINAL EXAM
The final exam will be 100 multiple choice questions. The questions will include all areas of seminar, lab, and tutorial. Include muscles, origin and insertion and nerve innervations. Questions will involve critical thinking and clinical reasoning.

LAB ASSIGNMENT/OSCE

ACTIVITY PROJECT WITH ACTIVITY ANALYSIS
Students will design an occupationbased activity appropriate to be use with the adult population. An activity analysis will accompany the activity. Each student will present their unique activity during lab.

OBJECTIVE STRUCTURED CLINICAL EXAMINATION (OSCE)
The OSCE is a practical assessment of student skills using a variety of simulated situations. For example, students may be asked to demonstrate an evaluation or treatment procedure appropriate to a written case, and to explain the rationale for this procedure. OSCE activities will require students to demonstrate their ability to apply their knowledge of the occupational therapy foundations, and to demonstrate adolescent and adult occupational therapy evaluation and intervention skills (see *Student Manual* for a more detailed description).

LECTURE ASSIGNMENT/EXAM

MIDTERM EXAM

A midterm exam will be administered in class during lecture time (refer to seminar outline for date). The midterm will be 50 multiple choice questions on the musculoskeletal system including muscle origin, insertion, innervations and action.

PRESENTATION

Each student will present an evidence-based evaluation/treatment protocol for a specific diagnosis. Each presentation will be 20 minutes in duration and will be presented using a conference/seminar format. Students will be expected to use professional behaviors and present material using multiple media tools (i.e. PPP, video, demonstration, interactive, experiential etc.).

Each protocol is expected to represent at least 3 evidence-based references. The presentation will be graded based on student and faculty presentation performance questionnaires. Students are expected to hand in their presentation for faculty review and grading.

FIELDWORK ASSIGNMENTS/EVALUATION

FIELDWORK ASSIGNMENTS

Students will chose ten fieldwork assignments from seven topic areas. At least three assignments should be SOAP notes, the rest are up to the students. The student should pick at least one from each of the seven categories. In addition, a journal will be required of all students. The academic fieldwork coordinator will provide information on the format. These will be submitted through Blackboard Drop Box.

FIELDWORK EVALUATION

The supervisor assigned to you at the facility or facilities in which you complete Adolescent and Adult Level I Fieldwork will be responsible for completing the student Level I Fieldwork evaluation on which your grade will be based. The Level One Fieldwork Assessment (see *Fieldwork Manual*) will be used for this evaluation.

CLASS PARTICIPATION

All students are expected to attend seminar, lab, and tutorial having read the assigned readings and lecture notes, being prepared to answer and participate in class discussion, question and answers. Class participation will not be part of the overall grade percentage breakdown. However, if a student has a borderline grade i.e.: between a B+ and A, if participation was consistent the instructor will give the higher grade.

WRITING POLICIES

All papers must be word processed, doublespaced, and in 12 point font. All papers must have 1" margins. Use APA style for formatting, personfirst language, and nonsexist language. If assignments do not meet this criteria, the grade will drop one

increment, for example, A to A. Plagiarism will not be tolerated in this course. The instructor will be checking for plagiarism via internet software.

APPENDIX E

PHYSICAL THERAPY PROBLEMBASED LEARNING COURSE SYLLABUS

[Faith Based] UNIVERSITY
PROGRAM IN PHYSICAL THERAPY

PT 612: STRUCTURE AND FUNCTION II

Semester:	Spring, Professional Year 1		
6 credits:	Large Group Discussion:	M, Th, F,	1112: 15
	Tutorial	T F	A & B: 12: 303:
15			
			C & D: 5: 00 7:
45			

Semester Team: xxxxxxxxxxxxxxxxx (Semester Coordinator)
xxxxxxxxxxxxxxxxx (CoSemester Coordinator)
xxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxx

PT 612 Contact: xxxxxxxxxxxxxxxxx

COURSE DESCRIPTION: This tutorialbased course will cover the structure and function of the normal and impaired neurological system. Anatomy of the central, peripheral, and autonomic nervous system will be examined in the context of patient cases with common neurological pathology to understand the interactive effects of normal, pathological, developmental or agerelated, and environmental influences on movement, perception, cognition, and social development (including motor planning, motor control, and motor learning). Students will also be introduced to the family as *a system in which individual development (physical, cognitive, psychological,* sociocultural) occurs. This course will also include several days of structured clinical exposure for each student over the semester that will be tied to semester coursework and will serve as a mechanism for understanding clinical relevance to practice and patient care.

The course is organized into three "functional" modules:

- Developmental Perspectives: CNS structurefunction, & Postural Control (Cases 18)
- SensoryMotor Systems: Mobility/Locomotion, Oralmotor& Communication (Cases 916)
- Integrative Systems: Cognition, Perception, Homeostasis, and Coordination (Cases 1724)

In each module, students will explore

1. anatomy and physiology of the CNS systems contributing to that function.
2. developmental aspects of that system (including agerelated changes in later life)
3. neuropathology that may impair the system (etiology, signs/symptoms, medical assessment, and medical/pharmacological management of the neuropathology)
4. "central set", environmental and other salient influences on function of the system (*ex. fear of falling on balance*)
5. family system issues in both typical development/lifespan perspective and in the face of neuropathology

TEACHING METHODS: Large group discussion and tutorial sessions, including:

1. Audiovisual aides, including anatomical models
2. Simulated patient problems
3. Self-directed and assigned exploration of related literature
4. Small and large group discussion
5. Student presentations

TEXTBOOKS FOR SEMESTER 2 (PT 612, PT 622, PT 632)

NEUROANATOMY TEXTBOOK: Students **CHOOSE ONE** of the following:

Gilman S, Newman SW. Manter & Gatz's Essentials of Clinical Neuroanatomy & Neurophysiology, 10th Ed., Philadelphia PA: FA Davis, 2003.

Haines DE. Fundamental Neuroscience, 3nd Ed., New York NY: Churchill Livingstone, 2005

Nolte J. The Human Brain: An Introduction to Its Functional Anatomy, 5th Ed, St. Louis MO: Mosby, 2002

Kiernan JA. Barr's Human Nervous System, 8th Ed., Philadelphia PA: Lippencott Williams & Wilkins Oct. 2004

NEUROANATOMY ATLAS: *Students, if interested,* ***choose one*** *of the following:*

Haines DE. Neuroanatomy: an Atlas of Structures, Sections, and Systems, 6th Ed. Philadelphia PA: Lippencott Williams & Wilkins, 2004.

Nolte J, Angevine JB. The Human Brain in Photographs and Diagrams, 2nd Ed. St. Louis MO: Mosby, 2000,

NEUROPATHOLOGY:

Poolos NP. Handbook of Differential Diagnosis in Neurology. Boston MA: Butterworth Heinemann, 2001.

MOTOR LEARNING AND MOTOR CONTROL:

Schmidt RA, Lee TD. Motor Control and Learning, 4th Ed, Champaign IL: Human Kinetics 2005

ShumwayCook A, Woollacott MH. Motor Control: Theory and Practical Applications, 2nd Ed., Philadelphia PA; Lippencott Williams & Wilkins, 2001

Recommended:

Montgomery PC, Connolly BH. Clinical Applications for Motor Control. Thorofare NJ: Slack, 2003, ISBN 1556425457

LIFESPAN DEVELOPMENT & FAMILY DYNAMICS

Craig GJ, Baucum D. Human Development, 9th Ed., Upper Saddle River NJ: Prentice Hall, 2002

Anderson S, Sabatelli R. Family Interaction: A Multigenerational

Developmental Perspective, Boston MA: Allyn & Bacon, 1995

NEUROMUSCULAR EXAMINATION:

Batavia M. The Wheelchair Evaluation: A Practical Guide. Boston MA: Butterworth Heinemann, 1998

Nolan MF. Introduction to the Neurological Examination. Philadelphia PA: FA Davis, 1996.

Quinn L, Gordon J. Functional Outcomes Documentation for Rehabiliation. Philadelphia: Saunders,

Zoltan B. Vision, Perception, & Cognition, 3rd Ed. Thorofare NJ: Slack 1996 ISBN 1556422652

Additional Recommended:

Dittmar SS, Gresham GE. Functional Assessment and Outcome Measures for the Rehabilitation Health Professional. Gaithersberg MD: Aspen, 1997

Finch E, Brooks D, Stratfrod PW, Mayo NE. Physical Rehabilitation Outcome Measures: a Guide to Enhanced Clinical Decision-making. Hamilton Ontario: BC Decker (US distributor: Lippencott Williams & Wilkins) 2002.

Strub RL, Black FW. The Mental Status Examination in Neurology, 4th Ed. Philadelphia PA: FA Davis, 1999.

NEUROMUSCULAR INTERVENTION

Campbell SK. Physical Therapy for Children 3rd Ed., Philadephia PA: WB Saunders, 2005.

Effgen SK. Meeting the Physical Therapy Needs of Children. Philadelphia PA: FA Davis, 2004

Gladson B, Pharmacology for Physical Therapists. Philadelphia PA: WB Saunders, 2005

Guccione AA. Geriatric Physical Therapy. St. Louis MO: Mosby, 2000.

O'Sullivan SB, Schmitz TJ. Physical Rehabilitation: Assessment and Treatment, 4th Ed, Philadelphia PA: FA Davis, 2001

O'Sullivan SB, Schmitz TJ. Physical Rehabilitation Laboratory Manual. Philadelphia PA: FA Davis, 1999.

Umphred DA. Neurological Rehabilitation 4th Ed., St. Louis MO: Mosby, 2001

Students **choose one** of the following Orthotics Texts:

Edelstein JE, Bruckner JB. Orthotics: A Comprehensive Clinical Approach, Thorofare NJ: Slack, 2002

Nawoczenski DA, Epler ME. Orthotics in Functional Rehabilitation of the Lower Limb. Philadelphia PA: WB Saunders 1997

Additional Recommended:

Connolly SK, Montgomery P. Therapeutic Exercise in Developmental Disabilities, 3nd Ed., Delmar Learning, 2004

Campbell M. Rehabilitation for Traumatic Brain Injury: Physical Therapy Practice in Context. Edinburgh UK: Churchill Livingstone. 2000

Carr J, Shepherd R. Stroke Rehabilitation: Guidelines for Exercise Training to Optimize Motor Skill, Butterworth Heinemann, 2003

Long TM, ,Cintas HL. Handbook of Pedicatric Physical Therapy. Baltimore MD: Philadelphia PA: Lippencott Williams & Wilkins 2001.

Techlin JS. Pediatric Physical Therapy, 3rd. Ed., Philadephia PA: JB Lippencott Williams & Wilkins 1999

US Department of Health and Human Resources. Post Stroke Rehabilitation. Gaithersberg MD: Aspen. 1996. SuDoc HE 20.6520: 16

Voss DE, Ionta MK, Myers BJ. Proprioceptive Neuromuscular Facilitation Patterns and Techniques, 3rd Ed., Philadelphia PA: Lippincott Williams & Wilkins. 1985

EVIDENCE IN PRACTICE / RESEARCH

Portney LG, Watkins MP. Foundations of Clinical Research: Application to Practice 2nd Ed., Upper Saddle River NJ: Prentice Hall, 2000

Recommended:

Domholdt E. Physical Therapy Research: Principles and Applications. 3rd Ed., Philadelphia PA: WB Saunders, 2005

Greenhalgh T. How to Read a Paper. 2nd Ed. London UK: BMJ Books, 2001.

EVALUATION & GRADING POLICY

1. Weekly Quizzes (average of the best 10 scores) 15%

2. Module Exams (content focused: applied anatomy & neuropathology, medical management)
   - Module 1: CNS Basics & Postural Control 15%
   - Module 2: SensoryMotor Systems 15%
   - Module 3: Integrative Systems 15%

2. Tutorial evaluation (process based)
   - Midterm 10%
   - Final 10%

3. Student Presentation 15%

4. Lifepan Development Executive Summaries (2) 5%

NOTE: knowledge of neuroanatomy, neuropathology, and medical management of CNS/PNS pathogies are considered foundational for OSCE and Triple Jump activities in PT 622 Examination and PT 632 Intervention/Documentation. Students should expect this foundational information to be integrated within the OSCE and Triple Jump processes that are part of these other courses.

CRITERIA FOR PASSING SEMESTER II COURSES: In order to successfully complete the course, all students must meet the following criteria:

Mean of 73 points or better on Written Exams: PT 612 Mean exam score will be calculated from quiz and module exam scores. Students with a mean Written Exam score of less than 73 points will automatically receive a failing grade for the course

Mean of B or better in tutorial evaluation : Students with a mean tutorial grade of less than B will be reviewed by the Professional Performance Committee for a recommended action.

Weekly Quiz: Each Friday (except during weeks of module exams), at the start of PT 612 large group discussion, the instructor will make a 1015 item multiple choice quiz available on the Blackboard system. The quiz will be available for completion for no more than 15 minutes. The quiz is an **individual** effort; each student will work on their own laptop computer. Quizzes will focus primarily on neuroanatomy. Large group discussion will begin promptly at 11: 15. The mean of each student's 10 best quiz scores will contribute 15% to the course grade.

Module Integrative Examinations: Formative evaluation of students' mastery of didactic content will be assessed in a series of crosscourse casebased multiple choice/short answer exams given at the conclusion of each module. Content on the exams relevant to PT 612 will include function of CNS subsystems and their relationship/contribution to the functional system studied in the module. Students will also be responsible for understanding typical medical assessment and management of neuropathologies typical of that system. A PT 612 grade will be calculated from appropriate items of the integrative crosscourse exam. Each PT 612 exam will contribute 15% to the overall course grade.

Tutorial Evaluation: Tutorial evaluations (self-evaluation as well as feedback from tutor and peers) are conducted informally for each student several times over the semester. Written tutorial evaluations occur at midterm and conclusion of the course. Tutorial evaluations contribute 20% toward the overall course grade

Presentations: Students will prepare and present 20 minute presentations on individual and family development as they relate to the practice of physical therapy with those having neuromuscular pathology, impairment, or functional limitation. Presentation will be graded on scope of content, and effectiveness of delivery. Presentation will contribute 15% to overall course grade.
Please Note: although presentations may be scheduled during 612, 622, or 632 LGD, they will be considered part of 612 grading.

Executive Summaries: Students will prepare a 2 page summary of key readings pertaining to individual and family development across the lifespan, including application to physical therapy practice, and provide copies of said summaries to their peers as resources. Chapters are assigned to students in alphabetical order. Each student will complete 2 executive summaries during the semester. Summaries are graded as high pass (100 points), pass (95 points) or fail (70 points). Mean summary score will contribute 5% to overall course grade.

CLASS PARTICIPATION: Students are expected to **come prepared** for large group discussions. Discussion will be driven by issues about neuroanatomy/physiology, pathology/pathophysiology, medical assessment and management, and motor control/learning related to patient cases from tutorial, as well as questions/concerns from preceding labs. Topics that will be discussed are included in the semester schedule.

ACCOMMODATION: Students with documented learning disability and those who for other reasons require additional time to complete written examinations must communicate this need to the course instructor/examiner no later than 48 hours prior to each scheduled exam. In cases of family or health emergency on the day of a scheduled examination, students are required to contact the instructor by phone or email as soon as possible (preferably prior to the exam) to explain the reason for unanticipated absence and to make alternative arrangements.

ACADEMIC DISHONESTY:
ACADEMIC DISHONESTY IN ANY FORM WILL NOT BE TOLERATED
It is incumbent on each student to avoid any situation that presents the appearance of academic dishonesty. Students are advised to seat themselves as far apart as possible during testing situations. Students must keep their eyes on their own work. All notes, books, backpacks, briefcases must be cleared from the student's immediate vicinity. Course instructors may terminate a student's examination if behaviors suggesting academic dishonesty are observed. A student suspected of academic dishonesty will be immediately referred to the Professional Performance Committee for review and possible disciplinary action. The definition of academic dishonesty and the criteria

by which students will be judged can be found in the DPT Student Manual and the University Graduate Catalog

PROFESSIONAL/PATIENT CONFIDENTIALITY: As health care professionals, physical therapists are have access and collect patient information that is defined as confidential and private. The APTA Code of Ethics clearly defines our responsibility to respect that confidentiality. This is true of information gathered about peers as part of lab activities or other learning actitivies, as well as information presented in cases or in patient presentations.

Scoring Criteria for Tutorial Evaluations Grade

(44 point scale)

Points	Letter Grade	Numerical Value
40 44	A	100
36 39	A92	93 96
33 35	B+	89
30 32	B	86
27 29	B82	83 86
24 26	C+	79
20 23	C	76
< 20	F	50

Scoring Criteria for Final Course

Points	Letter Grade
97 100	A+
A	
90 92	A
87 89	B+
B	
80 82	B
77 79	C+
73 76	C
< 73	F

(Grad)

6772 D+

(UG)

6366 D

(UG)

< 63 F

(UG)

TRANSCURRICULAR/TRANSSEMESTER OBJECTIVES

During and on completion of this semester, students will:

1. communicate more efficiently and effectively both verbally and in writing
2. use the process of peer evaluation and self-evaluation to facilitate personal and professional development.
3. identify, use, and appropriately document a variety of resources from which relevant information can be obtained.
4. demonstrate professional behaviors during all course activities, consistent with the Student Manual and APTA's Code of Ethics for Professional Behavior, including ethical and legal issues regarding confidentiality, informed consent, professional touch, sexual harassment, and assault and battery.

5. practice in a manner that is both safe and effective, minimizing risk to self and others (e.g., use of proper body mechanics, instructions, transfers, and use of equipment)
6. maintain and adhere to Universal Precautions in all appropriate situations.
7. know and carry out appropriate actions for any given emergency situation

PT 612 SPECIFIC OBJECTIVES

1. On completion of this course, students will be able to
2. identify the need for and obtain information on content and concept issues needed to understand structure of the nervous system and its subsystems, functional relationships subsystems, and clinical signs and symptoms relevant to a given a patient case.
3. understand the medical management of neuromuscular and neurological pathologies encountered in tutorial cases including: *
   a. etiology of, risk factors for, and most common presenting signs and symptoms of the pathology.
   b. medical test and technological methods used by physicians to in the medical diagnostic process (ex. angiography, CT, MRI, PET, SPECT, EEG, evoked potentials, etc).
   c. pathophysiological process underlying the diagnosis (including but not limited to CNS tissue response to inflammation, infection, thrombosis/embolism, hemorrhage, hydrocephalus, neoplasm, brain injury, and various degenerative diseases)
   d. typical options for medical and/or surgical management of the condition
   e. classes of medications/pharmacological agents typically used in the management of acute and chronic neuromuscular and neurological conditions (including actions, possible side effects, risk of adverse drug reactions, toxicity, and impact on homeostasis/blood pressure and cognitive function)
   f. pathophysiology and clinical implications of pain, including pain pathways, perception and meanings of pain, and the influence of pain on influence on motor behaviors and psychological functioning (ex. learning, problem solving).
   g. processes of tissue healing and scarring of various CNS cells and tissues (including but not limited to formation of glial scar, neural plasticity, collateral sprouting, hypotosis/regeneration, and intracranial pressure dynamics)
4. Describe the interaction of neuromuscular and neurological systems with the process of individual development and family dynamics over the lifespan ,including: *

5. intraindividual and environmental factors that influence the development of mobility skills in infants and young children
6. physical, cognitive, psychological and social aspects of typical development in childhood, adolescence, adulthood, and later life (including, but not limited to salient motor, perceptual, and cognitive milestones).
7. impact of inactivity and the influence of disease on health and quality of life, across the lifepan (especially in adulthood and later life).
8. normal and abnormal psychological and behavioral responses (including coping strategies and skills, grief and depression, and major classifications of mental illness).
9. the family (as an organizational system) as the context for development over the lifespan.
10. explain the structural, functional and physiological organization of the CNS including:
    a. levels of neuraxis as they develop during embryogenesis and as they contribute to function of the mature brain.
11. arterial and venous supply to surface and deep CNS structures, including their role in the manufacture and resorption of cerebrospinal fluid and intracranial pressure dynamics.
12. anatomical relationship of cranium, meninges, and CNS structures as they related to signs/symptoms and clinical findings in common CNS pathologies
13. basic neurophysiological processes, including neuron and glial cell structure and function, transmitter production and classification, the mechanism of synapse within the CNS and at the neuromuscular junction, pre and postsynaptic inhibition, factors influencing responsiveness or receptors, and implications for neuropharmaceutical interventions.
14. anatomy and neurophysiology of the reflex arc (muscle spindle, alpha motor neuron/final common pathway, gamma motor neuron) as it related to observed and inferred responses of muscle during reflex testing, involuntary movement, and volitional movement.
15. compare/contrast the assumptions and limitations of various models of motor control (ex. reflex, heirarchical, dynamical systems, pathokinesiological), including their relationship to the functional anatomy of the CNS, perspective on development, contribution to normal movement, and implications for physical therapy assessment and management of movement dysfunction related to common CNS pathologies.
16. use one's understanding of muscle spindle structure and function to explain differences in response to deep tendon reflex testing for patients with neuropathy, stroke, spinal cord injury, and other movement disorders.
17. explain the organization of sensory and perceptual systems important for postural control and movement (visual, vestibular, spinocerebellar) in normal

and selected pathological conditions, including:

a. structural and functional characteristics of peripheral receptors

b. structural and functional characteristics of peripheral and central pathways

c. sites and types of processing and integration of sensory information (peripheral, subcortical, and cortical)

d. influence of these sensory/perceptual systems on cortical and subcortical motor centers involved in postural control.

18. differentiate between static, anticipatory, reactionary, and dynamic postural control, and how each plays a role in normal movement.

19. relate the structures and organization of the Cerebellum (feedforward/feedback) to coordinated purposeful movement & postural control in normal and pathological conditions (ex. chronic alcoholism, closed head injury)

20. explain the organization of sensory (spinothalamic and dorsal column/medial lemniscal) and perceptual systems important for mobility and locomotion, in normal and selected pathological conditions, including:

a. structural and functional characteristics of peripheral receptors

b. structural and functional characteristics of peripheral and central pathways

c. sites and types of processing and integration of sensory information (peripheral, subcortical, and cortical)

d. influence of these sensory and perceptual system on cortical and subcortical motor centers important in mobility and locomotion.

21. explain the contribution of the various nuclei of the Basal Ganglia (including neural transmitters) to motor function (postural tone, motor planning, motor learning) in normal and pathological conditions (ex. athetosis, Parkinson's disease, Huntington's disease).

22. compare/contrast components of pryamidal and extrapyramidal motor systems and their contributions to goal directed movement (CNS motor centers, descending pathways, alpha vs. gamma motor neurons).

23. explain the organization of the auditory and auditoryperceptual systems important for communication, cognition, and memory in normal and selected pathological conditions, including:

a. structural and functional characteristics of peripheral receptors

b. structural and functional characteristics of peripheral and central pathways

c. sites and types of processing and integration of sensory information (peripheral, subcortical, and cortical)

d. influence of this sensory and perceptual system on cortical and subcortical motor centers important in for problem solving and learning.

24. explain differences in clinical signs/symptoms for lesions in different areas

and/or hemispheres of the brain, based on one's understanding of hemispheric specialization, including sensory perception (agnosia), higher cognitive function, mental status, and memory (dementia, delirium, depression), and communication & language (aphasia).

25. apply knowledge of cranial nerve structure, function, and CNS interconnections to explain clinical signs and symptoms, including visualmotor dysfunction, dysarthria, and dysphagia.
26. apply knowledge of reticular formation structure and function, to explain consciousness and sleep, variability in muscle tone, respiratory & other vegetative functions, and sensory integration in normal and pathological conditions (ex. closed head injury)
27. explain the role of the hypothalamus and various limbic system structures in autonomic function, memory, learning, and motivation.
28. explain the normal structure and function of the neuroendocrine systems as it relates to homeostasis and stress response, including the efficacy of the system during growth and development, and the aging process.
29. describe "normal" development of reach and grasp and other fine motor functions, incorporating current concepts of motor learning into mastery of fine motor tasks.
30. describe the benefits/limitations of various assisted technologies for individuals with neuromuscular impairment.

STUDENT PRESENTATION SCHEDULE:

Present	Date:	Topic (Class Session)
1. Th (612 LGD)	2/2	Family Dynamics during an Acute (Life Threatening) Illness
2. Th	2/2	The Role of "Play" in the Developmental Process (612 LGD)
3. F	2/3	What to do when you suspect child abuse (PT 612 LGD)
4. T (632 LGD)	2/14	Strategies to enhance function for those with visual impairment
5. M (612 LGD)	2/27	Family Dynamics in the face of Chronic Illness Conditions
6. M (612 LGD)	3/13	Coping Styles, Skills, and Strategies in Chronic Conditions
7. T LGD)	3/14	The who, what, where, and why's of Birth to 3 Programs (632
8. T	3/14	Feeding programs for individuals with dysphagia (612 LGD)
9. M	3/20	Recognizing & responding to Learning Disability (632 LGD)

10.	M	3/20	Crosscultural issues in neuromotor rehabilitation (612 LGD)
11.	Th	3/30	*The who, what, where, and why's of Assisted Living* (612 LGD)
12.	Th	3/30	Development in Later Life: Role of Senior Centers (612 LGD)
13.	M	4/4	Development in Adolescence: High Risk Behaviors (612 LGD)
14.	Th	4/20	Elder Drivers (612 LGD)

EXAMINATION, OSCE & TRIPLE JUMP SCHEDULE

Date:		Evaluation Event
W	2/15	Evidence in Practice Exam 1
W	2/22	Module 1 Exam (Cases 18)
		OSCE Module 1
W	3/22	Evidence in Practice Exam 2
W	3/29	Module 2 Exam (Cases 916)
		OSCE Module 2
W	4/26	Evidence in Practice Exam 3
T	5/2	*Module 3 Exam (Cases 1725)*
W	5/3	Module 5 Integrative Exam: Upper Extremity
Th	5/4	Comprehensive Triple Jump Part 2
F	5/5	Comprehensive Triple Jump Part 3

INTEGRATED CLINICAL SCHEDULE

Date:		Topic
W	1/25	Task Analysis: Observation of Individuals with Stroke
W	2/8	Baby Day at SHU (assessing infant development, postural control)
W	3/1	Gait Observation & Documentation Day
W	3/15	Observation of Kids Gross Motor Day
W	4/5	Observation of/Interaction with Individuals with Cognitive Dysfunction
W	4/19	*Observation of/Interaction with Individuals with Acquired Brain Injury*

PT 612: Individual and Family Development Across the Lifespan

PRESENTATION GUIDELINES

There are three studentcentered goals for this assignment:

1. To access current (1995 to date) research and clinical literature as sources of information.
2. To integrate this information into an organized presentation, and to apply it to the practice of physical therapy.
3. To present this information in a stimulating, creative, and cohesive manner.

The presentation must be no longer than **15 minutes** in length, with an additional 5 minutes for questions and discussion.

The presenter/s must provide a one page, typed outline of the presentation, and distribute it to the class prior to the presentation.

The presenter/s must provide ONE allinclusive reference list (at least 10 sources) to the class prior to the presentation.

The use of other handouts and/or media (posters, overheads, PowerPoint) is strongly recommended.

Groups are responsible for organizing themselves, and ensuring all members contribute equally to the assignment.

When there is more than one presenter, all members of the group will receive the same baseline grade for the presentation. Each group member will complete a self and peer evaluation, which will be added to the overall presentation grade.

A few helpful suggestions:

- ⇨ Get organized for the presentation early in the semester (it can be a disaster if you wait until the week of your presentation to begin to prepare)
- ⇨ Clarify the scope of your topic with the course instructor early in the process to make sure you're on the right track in your research and information seeking.
- ⇨ Clearly define each group member's responsibility, and set deadlines for preparing bibliography and handouts.
- ⇨ Practice the presentation together at least twice to make sure your content and teaching strategies "fit" into the time allotted for the presentation
- ⇨ Make sure all handouts are copied, collated, and stapled prior to the day our presentation. Distribute your packets at the start of class on the day of your presentation.
- ⇨ Peer evaluations are due on the day of your presentation, no exceptions.

PT 612: Individual and Family Development Across the Lifespan

Presentation Evaluation Format

Group Members: _____ **Date:**

_____

_____

		Possible Points	Earned Points
I.	The presenter/s are well prepared for the presentation		
	1. Student/s prepare a bibliography on their topic for distribution	5	
	2. Bibliography is in AMA format (as in *Physical Therapy*)	2	
	3. Student/s prepare and distribute an outline of the presentation	5	
II.	The presentation is successfully delivered, in an organized fashion within the allotted time period.		
	1. The presenter/d demonstrate effective teaching and communication strategies during the presentation	10	
	2. The presentation is completed within 15 minutes	3	
	3. The presentation is logically organized	5	
	4. The presentation provides a clear overview of key concepts assumptions, issues, or limitations related to the topic	15	
	5. Relevance of the information to health professionals is made clear	15	
	6. The presentation identifies unanswered questions or unresolved controversies about the topic	10	
	7. The presentation is creative and stimulating, making use of appropriate visual aides or activities.	15	
	8. The presentation actively engages participation of peers, and stimulates discussion	10	
	TOTAL POINTS for Presentation:	95	
	Mean Self & Peer Evaluation Score	5	
	OVERALL SCORE for the Presentation	100	

Comments:

PT 612: Individual and Family Development Over the Lifespan

Presentation Self & Peer Evaluation Form

Person being evaluated

_____

Name of evaluator:

_____

Title of your presentation:

_____

Date of your presentation:

_____

Use the following guidelines to rate yourself and each member of the group on the process of preparing for your group presentation. Circle the number with best describes the contribution of the individual being evaluated.

5.0 Excellent preparation, made major creative contributions, added an important perspective, provided major energy and leadership, really outstanding, well above expectations.

4.5

4.0 Good preparation and active participation, enthusiastic, committed and responsible, performed at an "above average" level in the group.

3.5

3.0 Adequate preparation, worked well in the group, did what was required, performed at average expectations

2.5

2 Prepared and cooperative, but not much initiative; responsible but somewhat passive, not as enthusiastic or creative about the project as other group members

1.5

1.0 Required others to provide reminders of responsibilities, due dates, or meeting

times. Would not have followed through on responsibilities without prompting.

0.5

0.0 Contributed little or nothing to preparation, required explicit direction and monitoring of other group members, minimal participation.

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GRADUATE PROGRAM IN OCCUPATIONAL THERAPY
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PBL TUTORIAL FACILITATOR TRAINING HANDBOOK
2005 2006
AND THE
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20052006

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ABSTRACT

CRITICAL THINKING AND EVIDENCE-BASED PRACTICE IN PROBLEMBASED LEARNING TUTORIAL GROUPS: A CRITICAL CASE STUDY

Joanne M. Bortone, Ed.D.

Fordham University, New York, 2007

Mentor: Toby Tetenbaum, Ph.D.

Little research has investigated how problembased learning (PBL) instruction influences students' critical thinking and evidence-based practice. This research sought to ascertain if PBL instructional practices facilitated critical thinking and EBP; identify those practices; and, identify changes students made in tutorials.

A qualitative, twocase, critical case study design used pretest and posttests of the *California Critical Thinking Skills Test (CCTST)* (Facione, 1990) and *Self-Evaluation of EBP* adapted from Straus et al. (2005) to select the critical case sample. Students who made the greatest gains from preto posttest scores met selection criteria for the critical case sample and were invited to participate in a onetoone interview with the researcher. The interview focused on obtaining students' perceptions as to *what group, PBL tutorial, and tutor factors they thought contributed to the change in* their scores.

Thirty first year, second semester students and PBL tutors from the graduate occupational and physical therapy programs at one university participated. Triangulation of data increased credibility of the findings. Data included a total of eighteen ethnographic observations of six PBL tutorial groups on three occasions throughout the semester; interviews with ten students meeting selection criteria for the critical case sample; analysis of curriculum and course documents, and students' handouts they produced for PBL tutorials.

The study found that students made improvements in their critical thinking and EBP. The study exposed essential tutorial group elements that were instrumental in facilitating the development of students' critical thinking and EBP; group format, the tutor's facilitation skills, student's disposition; feedback, and the PBL method. Curriculum design emerged as critical in contributing to the development and application of EBP in PBL tutorials.

The study's findings revealed a need for ongoing tutor education and supervision and for specific pedagogical practices to be integrated across the curriculum to facilitate critical thinking and EBP. Students improved their critical thinking and EBP, with group format, tutors' modeling of critical thinking, student disposition, feedback, and curriculum design emerging as primarily influential. Implications for curriculum design, faculty education, and future research are discussed.

VITA

JOANNE M. BORTONE

Date of Birth	November 18, 1951
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High School	Manchester High School Manchester, Connecticut *Graduated June 1969*
Associate of Arts Liberal Arts	Centenary College Hackettstown, New Jersey Conferred May 1971
Bachelor of Science Occupational Therapy	Columbia University New York, New York Conferred January 1974
Master of Arts Occupational Therapy	New York University New York, New York Conferred January 1984
Academic Positions	Clinical Assistant Professor Programs in Occupational Therapy New York University New York, New York 1983 1986
Present Position	Chair and Director and Assistant Professor Graduate Program in Occupational Therapy Sacred Heart University Fairfield, Connecticut 1999 Present