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Case-Based Learning (CBL) in
Selected Physical Therapy Curricula and
Its Perceived Effectiveness by Students, Faculty, and Administrators

A Dissertation

Submitted to the Graduate Faculty of the
University of New Orleans
in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy
in
Education
Curriculum and Instruction

by

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May, 2010

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Dedication

*This is dedicated in memory of Ann Adams Reeder
who first introduced me to case-based learning,
was a wonderful mentor to me,
and was a fellow carrier of the torch.*

Acknowledgements

There are numerous people who have provided the vital support, mentoring, motivation, and assistance in order to make this research possible. First, I would like to acknowledge the LSUHSC New Orleans School of Allied Health Professions administrative and support staff that provided the funding and administrative support to make this project feasible. I would especially like to recognize and thank all of the participating administrators, faculty members, and students who were willing to give of their time and share their experiences with me during my data collection. I would also like to thank the administrative personnel at these programs who were instrumental in coordinating and scheduling the site visits. It truly made me proud to be part of such a wonderful profession where everyone was so willing and open to have a researcher come in and take up a day in their program. Everyone that I came in contact with at all eight of the academic programs studied were extremely friendly, helpful, and supportive.

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Abstract

Case-based learning (CBL) is commonly used in physical therapy curricula even though not much evidence exists as to the effectiveness of this instructional tool in physical therapy education. Through qualitative evaluation methodology, the researcher investigated the utilization and implementation of this instructional methodology in selected physical therapy curricula, as well as its perceived effectiveness by physical therapy students, faculty, and administrators. Data collection was performed through classroom observations, interviews, and focus group interviews at eight physical therapy programs across the United States that identified themselves as moderate to high implementers of CBL. Through the analysis of the qualitative data gleaned from the participants, case-based learning was found to be a very effective instructional methodology in these academic programs as described by administrators, faculty, and students alike. Specifically, case-based learning was found to effectively enhance students' learning, problem solving skills, clinical preparedness, and confidence levels. Barriers that may limit the effectiveness of the implementation and utilization of case-based learning were discussed, including stakeholder buy-in, time and cost requirements, an individual knowledge and skill with case-based learning techniques. Multiple factors were found to exist that positively influence the effectiveness of the implementation and utilization of case-based learning including techniques that make the learning experience safe, real, impactful, and empowering.

Keywords: Case-based Learning, Case Method, Case-based Teaching, Physical Therapy Education, Curriculum Evaluation

Chapter One

Introduction

Case-based pedagogy is a tool commonly used in the field of physical therapy education. This methodology was first utilized with its introduction into the curriculum of Harvard Law School in 1870. The reception of this new methodology into the halls of academia was all but warm. This “inductive” pedagogy went against the popular methods of instruction of the time (lecture and book recitations) that maintained the control of the professoriate (Kimball, 2006). Even though scrutinized early, this methodology spread throughout law schools and was first introduced into the field of medicine at Johns Hopkins University in 1893 (McNergney, 1999). Since then, this methodology has grown to be incorporated into many classrooms including the field of physical therapy education as well as other health science professions.

Problem-based learning (PBL) in its purest form is a much younger teaching method. One of the first programs to utilize problem-based learning formally was McMaster University in its School of Medicine (Neufeld & Barrows, 1974). Even though McMaster University has been ascribed as the pioneers of this instructional methodology, other sources have discussed the utilization of instructional methods very similar to that of PBL at Case Western Reserve University a full two decades before the “McMaster Philosophy” came about (Boud & Feletti, 1997). A full contrast and comparison of case-based and problem-based learning will be provided later in this paper due to the fact that much discrepancy exists in the nomenclature of these two instructional techniques.

Physical therapy is a specific branch of health sciences that deals with the diagnosis and treatment of movement dysfunction with the implementation of specific interventions. The

content of physical therapy curricula is dictated and influenced in part by multiple sources outside of the individual schools including the Commission on Accreditation in Physical Therapy Education (CAPTE), the American Physical Therapy Association (APTA), the clinicians actively practicing in the field, and the ongoing research in the subject area. Thus, there are aspects of physical therapy curricula that are fairly constant and aspects that are constantly changing. Because this content is continually in flux, teaching methods are aimed at how to learn rather than specifically what to learn. The pedagogical tools utilized are chosen to reinforce clinical problem solving and critical thinking skills as to create lifelong learners who will have the means to change with the field as it grows and evolves.

Physical therapy is also a subculture of healthcare professionals with its own specific language, values, and customs. Physical therapy education programs are the medium through which students are acculturated into the field of physical therapy. This acculturation process cannot be taught in a lecture, and is best passed down by actively participating in the rituals and practices of the profession. Case-based learning (CBL) is a tool commonly used in physical therapy curricula to promote this active participation of learners and development of problem-solving skills. However, not much evidence exists in the literature to support the use of this methodology in physical therapy educational programs.

Purpose and Research Questions

The purpose of this study was to evaluate the utilization and implementation of case-based learning in selected physical therapy schools across the country, as well as to identify indicators of effective implementation of CBL in physical therapy programs and to gain a better

understanding of the perceived effectiveness of this methodology from physical therapy students, faculty, and administrators in these schools.

Through the use of qualitative methodology, I intend to answer the following questions:

- To what extent are the selected physical therapy programs utilizing CBL in their curriculum and what different ways are they formatting, structuring, and applying CBL in the classroom?
- What are the factors that impact the effectiveness of implementation of CBL and what indicators exist that denote effective implementation of CBL in the selected physical therapy curricula?
- What is the perceived effectiveness of CBL in delivering physical therapy curricula by physical therapy students, faculty, and administrators of the selected physical therapy programs?

Definition of Case-based Teaching and Learning

In general, case-based instruction is the utilization of real-life, contextual cases as instructional tools for students to actively engage in problem-solving and inductive inquiry. Kim et al. (2006) describes the use of case-based learning in medicine as a process by which the learners utilize current knowledge to assist in the examination, evaluation, diagnosis, and management of imaginary patients. A consistent definition of case-based teaching and learning, however, may be more elusive in practice and in theory due to the wide variation of its utilization and different interpretations of its meaning. Although many studies have described CBL differently and offered numerous definitions, to date no study has looked at the

denotation of case-based learning as it is used in practice in either the field of physical therapy specifically nor in the field of education in general.

One of the inconsistencies noted in the literature is the delineation of problem-based and case-based learning. Many authors describe case-based learning as a type of problem-based learning (PBL) (Barrows, 1986; McKeachie & Svinicki, 2006) and often the two terms are used interchangeably (McCannon, Robertson, Caldwell, Juwah, & Elfessi, 2004; Ryan & Marlow, 2004; Vanleit, 1995). Herreid (1994) even described PBL as a method of CBL, which is different than that most often seen in the literature. Barrows (1986) noticed this discrepancy in nomenclature and introduced a taxonomy for classifying problem-based methods and included case method instruction as one of the types of PBL. He described six different categories of problem-based learning strategies ranging from lecture-based cases (using cases as mere examples while giving formal lecture) to closed-loop problem-based method (full problem-based learning where students are even responsible for their own feedback through metacognitive processes). Table 1.1 provides definitions of the different PBL methods of the Barrow's Taxonomy and presents a breakdown of these methods based on three differentiating features of the methods. The differentiating features he described to delineate these methods were the amount of information given in the case, the amount of resources offered to the students (more with case method and less with problem-based), and the role of the facilitator (more interactive with case method and less with problem-based). Many educational programs have adopted Barrows' classification system and have implemented case-based and problem-based programs accordingly (Katsikitis, Hay, Barrett, & Wade, 2002; Srinivasan, Wilkes, Stevenson, Nguyen, & Slavin, 2007). Maudsley (1999) described the taxonomy by Barrows as

being more of a process through which the learner may progress to more of an independent learner and critical thinker.

Table 1.1 Barrow’s Taxonomy of PBL Methods

Name	Definition	Student/ Instructor Role	Amount of Case/Problem Given	Amount of Resources Provided
Lecture-based Cases	Case presented in confines of a lecture	Instructor-centered	Complete case given as example	All needed resources provided
Case-based Lectures	Cases used as adjuncts to lecture	Instructor-centered	Complete case given as resource	All needed resources provided
Case Method	Case used as medium for learning	Partially student & instructor-centered	Complete case given for discussion	Partial resources provided
Modified Case-based	Student groups work through case	Student-centered w/ instructor facilitation	Partial case given w/ stimulus questions	Partial resources provided
Problem-based	Student groups work on case from scratch	Student-centered w/ instructor feedback	Small case vignette or problem provided	Minimal to no resources provided
Close-looped Problem-based	Self-directed study of case or problem	Student-centered (feedback as well)	Small case vignette or problem provided	Minimal to no resources provided

Barrows differentiated between the two (PBL and CBL) by defining CBL as a situation where the learner is given complete case information and the learning activities are partially directed by the facilitator with some self-directed learning on the part of the student. He defined PBL as a method where students are provided with very limited case information (enough to pose a problem) and where there is little to no structure given by the facilitator.

Tärnvik (2007) further described the characteristics that differentiate PBL and CBL. The author

described PBL as a small-group and student-led process, where the facilitator merely observes and provides feedback with regards to the process of clinical decision making; whereas, CBL is conducted with larger groups, is more instructor-centered with regards to the problem-solving process and the focus is more on facilitating discussion on subject matter that has already been introduced to the learner through lecture or reading for the purpose of reinforcing and clarifying the content.

For the purpose of this paper, I will be using the terminology and definitions from Barrows' Taxonomy to maintain clarity in discussing PBL and CBL.

Another definition requiring clarification here would be the concept of a "case". Herreid (1997) defined cases as "stories with a message." He further defined cases as descriptions of events, fact or fictional, designed specifically to provide a purposeful learning experience above that of mere entertainment. He did describe how the role of entertainment is vital to the learning process in that it assists the instructor in capturing and maintaining the attention of the student during the learning experience.

A case can assume many different forms depending on the setting and content of instruction. For example, in business education, a case may be a large corporation experiencing a major merger in the market; in law a case can be a specific court case; and in the health sciences, a case can be a patient with a certain diagnosis or presenting symptoms.

Maudsley (1999) discussed multiple definitions for cases and problems as they are used in CBL and PBL literature. In this discussion, problems were described as issues presented that require some level of explanation or solution in order to be best understood and mediated; whereas, a case presents a scenario of some sort that requires the learner to apply current

knowledge, skills, and clinical decision making processes in order to appropriately manage the case.

McGinty (2000) specifically discussed the utilization of CBL in physical therapy education and gave strong rationale for its use in physical therapy curricula. She defined a good case as “a nagging question that creates a dilemma, provokes an emotional response, and invites investigation.” In her discussion article, she described many different types of cases that can be utilized in physical therapy curricula. Most commonly, cases are physical therapy patients (either real or imaginary) with a presenting problem or diagnosis that students must work through to create an examination strategy, postulate a physical therapy diagnosis, and devise a plan of action to address the problems the patient faces. Even though this would be the normal use of cases, many different methods of case utilization exist in practice. Thus, no strict definition of what a case is will be delineated here due to the fact that part of the purpose of this study is to identify what faculty use as cases in the practice of delivering physical therapy content.

As stated previously, this study examined three separate components of case-based learning in physical therapy education: utilization, implementation, and effectiveness. In studying implementation, I investigated how the programs structured and infused CBL in the delivery of their curricula. I also identified programs that implemented CBL in individual classes versus at a program level where content from multiple courses was covered in one case to integrate coursework. I was also interested to determine if CBL was being implemented at a school-wide level that delivered interdisciplinary content in one integrative case in any of the programs studied.

Utilization of CBL in physical therapy education describes how the individual cases are developed and delivered, as well as how the overall learning experiences are being structured. For example, some components of utilization may include decisions regarding the use of real vs. imaginary patients, face to face vs. online learning experiences, and many more that will be discussed later in this paper. One of the most difficult aspects to define is effectiveness. From an evaluation perspective, I looked to identify how well CBL met the intended goals and objectives of the learning experience. The individual goals of each case and the broader objectives of the utilization and implementation of CBL vary between and within institutions; thus I identified these in each program studied in order to define the overall effectiveness of the CBL utilization and implementation.

Significance of Study

Rationale for Use of Case-based Learning

Numerous sources have discussed the rationale for using case method teaching in the classroom settings of multiple disciplines. McGinty (2000) specifically addressed the rationale for use of case-based methodology in the field of physical therapy education. She posited that CBL methodology was able to meet specific needs to address challenges unique to the education of physical therapy students. Although this is one of few articles that addresses the use of case-based learning in physical therapy education, it is only a discussion paper and does not present any new knowledge to demonstrate the effectiveness of CBL in physical therapy curricula. The major attributes of case-based methodology that deem it such a beneficial technique in the education of physical therapists are its promotion of active learning, its development of problem-solving skills, its contextual nature, and its ability to motivate learners.

Promotion of active learning. John Dewey (1916) discussed how education occurred through experience and that the learner had to be actively involved in the process for true learning to occur. With true implementation of case-based methodology the learner works through the problems of the case and gains knowledge through actively applying content to the case itself. Chickering and Gamson (1987) believed that this was such an important aspect that they included active learning as one of the *Seven Principles for Good Practice in Undergraduate Education*. Jerome Bruner (1990) agreed with this importance of active learning, writing that all specific skills and practices of human beings must be learned through active performance. The acts being learned through the application of case-based methodology are problem-solving skills and critical thinking about the content included in the case. If physical therapy content were merely a list of things to be memorized, traditional passive methods of instruction may be adequate to achieve this goal. However, with the ever increasing responsibility of the physical therapist, one must learn how to think critically and analytically. This is a skill that is best learned, as Bruner puts it “by use”. Another aspect of active learning was described by Barrows (1986) as the “development of effective self-directed learning skills.” Because the student is partially or fully responsible (depending on the level of implementation between case method and problem-based learning) for structuring their own learning, they gain skills of self-introspection and self-discipline. Yadav, et al. (2007) surveyed 101 collegiate science teachers regarding their use of case-based learning in a multitude of differing scientific fields. Of the scientific fields represented, the overwhelming majority were in the biological sciences (44%). The authors found that through the use of CBL methodology, students were more involved in classroom activities (93.8% of respondents), took a more active role in their own learning

process (95.1%), developed stronger interpersonal skills and relationships (80.1%), and improved their communication skills (78.8%).

Development of problem-solving skills. Correctly designed cases present information in a specific manner in order to spark inquiry and guide students in a certain direction so that they create relationships in their understanding of material. In this manner, case methodology finds its roots in the constructivist epistemological camp. Williams (1996) described multiple attributes of case-based pedagogy that reflect constructivist theory including active participation of the learner and the importance placed on multiple points of view. Prerequisite to the ability to solve clinical problems in the health sciences is the ability to engage in critical thinking. In the survey described in the previous section, Yadav, et al. (2007) found that college professors who utilize CBL in their classrooms feel that through the use of CBL, students demonstrate stronger overall critical thinking skills (88.8% of respondents). They went on to describe the perceptions of student abilities in specific components of critical thinking to be high as well, including the ability to view materials from multiple different perspectives (91.3%), develop deeper understanding of concepts covered (90.1%), and make connections across multiple content areas (82.6%). Herreid (1994) described the importance of learning the *process* of problem solving as opposed to an emphasis on the *product* found through analyzing a case. He discussed how the use of CBL helps to imitate the problems faced in the everyday activities of professionals that the students are being trained to become. In the medical field, too many diagnoses exist for a physical therapy student to learn every diagnostic tool and intervention plan to use for every diagnosis in the course of their didactic preparation. Thus,

while it is important that students acquire knowledge, it is imperative that they learn the process of learning and problem-solving, which is required when diagnosing all maladies.

Contextual nature of case-based pedagogy. The overall purpose of case-based methodology is to facilitate learning through application of knowledge in real world contexts. Not only are the students actively participating in the learning experience, they are doing so in a manner that will be the context in which they will be required to perform tasks in real life. Thus, the learning is directly applicable to the context within which the learned task exists. Herreid (1994) stated this as “learning how to grapple with messy real-life problems ... ‘It’s a rehearsal for life’”. Barrows (1986) described this as one of the top educational objectives of problem-based learning. He described the importance of structuring learned material in a way that is directly applicable to true practice. This aspect lends itself very well to physical therapy education. At all levels of the educational process, patient scenarios can be presented for discussion and inquiry that can directly relate content to the students’ future profession.

Ability to motivate learners. McKeachie and Svinicki (2006) expressed the vital importance of intrinsic motivation on the part of the learner for true learning to occur and be effective. Many authors describe the ability of case-based methodology to motivate students (Angeli, 2004; Barrows, 1986; Herreid, 1994). Through actively involving students and promoting increased meaning of the learning process through its contextual nature, the case method of teaching is excellent at intrinsically motivating learners. Herreid (1994) described how attendance rates for case-based classes nearly doubled that of traditional lecture format classes in comparable courses (95% compared to 50-65%). This outwardly reflects the intrinsic motivation of those students with the only difference in courses being the instructional

methodology utilized. It is this ability to motivate the learner, actively involve the student in the learning process, tie the learning process to the context within which it exists, and promote the enhancement of problem-solving skills that makes case-based pedagogy an excellent technique to be used in physical therapy curricula.

Barriers to Use of Case-based Learning

In describing utilization and implementation of case-based pedagogy, it may have been noted that there are numerous, time consuming requirements of the instructor and student in utilizing this methodology. It is noted throughout the literature that this instructional technique is much more time-consuming compared to traditional lecture or classroom discussion. Barrows (1986) suggests that the available time and resources must be taken into consideration when choosing the level of PBL to implement.

One other major requirement of case-based instruction is faculty development. McNergney (1999) described all that goes into developing a successful case-based learning experience by stating that,

Organizing instruction for case-based teaching involves case selection and case integration within the curriculum, familiarity with skills of case analysis, discussion, and debriefing, and decisions about case applications, objectives, and outcomes. Presenting an excellent case does not necessarily guarantee an excellent case discussion. An instructor's ability to lead and facilitate a case discussion, based on a plan for analysis, makes or breaks a case discussion.

(p. 25).

To utilize cases correctly, Herreid (1994) noted that faculty were often required to learn new skills, which led to varying degrees of discomfort. His research suggested that it may prove difficult to convince overburdened members of the professoriate of the effectiveness of case-based learning. Many authors have studied and described multiple barriers to the utilization and implementation of CBL and PBL. (Hung, Bailey, & Jonassen, 2003; Lee, 1999; Solomon & Finch, 1998; Tarnvik, 2007; Thompson & Williams, 1985; and Yadav et al., 2007). A compiled list of these barriers addressed by a selection of authors is presented in Table 1.2.

These barriers are broken down into those perceived by the institution or faculty members alone and those perceived by faculty and students together.

As can be seen in the table, the most commonly discussed barriers include problems with the learners' abilities to transition to the type of learning required by CBL and PBL, balancing limitations on the amount of time faculty can dedicate to facilitate and teach using these methods, the difficulty in addressing broad ranges of curricular content as well as the depth of content while teaching with CBL/PBL, and the difficulty in assessing student learning when using these teaching methods in the classroom. As can be seen, many other barriers exist as well.

So why go through the difficulty of training faculty, creating cases, devising evaluation schemes, and implementing this in our classrooms? As stated before, not much evidence exists to support the effectiveness of case-based instruction in physical therapy programs. However, many authors have written that students perceived case-based teaching as being very beneficial (Cliff & Wright, 1996; Katsikitis et al., 2002; McCannon et al., 2004; Peplow, 1996). Srinivasan (2007) found that an overwhelming majority of students and faculty of two separate

Table 1.2 Common Barriers to Utilization & Implementation of CBL/PBL

Paper Barrier	Tarnvik (2007)	Hung, Bailey & Jonassen (2003)	Thompson & Williams (1985)	Yadav et al. (2007)	Solomon & Finch (1998)	Lee (1999)
Institutional & Faculty Perceived Barriers						
Complacency & Resistance to Change			X			
Costly to Implement			X			X
Pedagogical Belief re: Role of Teacher		X				X
Time Constraints			X	X	X	X
Large Class Size						X
Difficulty Creating/ Finding Cases	X			X		X
Faciliator Ability/Training	X					X
Faculty & Student Perceived Barriers						
Limited Breadth of Content		X	X	X		X
Diminished Focus on Facts		X	X			X
Difficult to Assess Learning			X	X	X	X
Students Not Responsible Enough						X
Misunderstanding of CBL/PBL					X	X
Difficulty with Group Learning					X	
Difficulty of Student Transition to PBL		X	X	X	X	X

medical schools preferred case-based teaching over problem-based teaching (90%/78% and 85%/100% respectively). Other authors described how student performance greatly increased

with utilization of case-based methodology (Cliff & Wright, 1996; Katsikitis et al., 2002; Lundebergh et al., 2002; Peplow, 1996; Waydhas, Taeger, Zettl, Oberbeck, & Nast-Kolb, 2004). Lundebergh et al. (2002) also described how student study habits were better in case-based learning courses compared to those in traditional lecture format courses. Of course, further research is needed in this area to examine the effectiveness of this methodology in physical therapy curricula.

Rationale for Present Study

In November, 2006, the American Physical Therapy Association (APTA) Board of Directors approved the document, *Education Research Questions in Ranked Priority Order*. This document presented the findings of a survey of the physical therapy education community regarding the need for educational research in the field of physical therapy. Of the 134 topics ranked, the highest priority topic was found to be “What factors are associated with student learning, development, and performance and quality academic teaching?” The eighth- and tenth-ranked questions dealt with identifying how instructional methodology and innovation affects student learning (American Physical Therapy Association [APTA], 2006). Much literature has been produced discussing the use of case-based instruction in the classroom of multiple disciplines; however, not much evidence exists regarding the use of case methodology specifically in physical therapy curricula.

As of March 23, 2010, 203 physical therapy education programs, representing 96% of all programs in the United States, had moved to a doctoral degree (APTA, March 2010). As of August, 2006, 48 states had been granted “Direct Access” to physical therapy in their respective state constitutions. This means that a patient can go directly to a physical therapist without a

referral from a medical doctor (APTA, August 2006). This increase in autonomy requires that physical therapy education programs place more emphasis on clinical decision-making in order to provide entry-level clinicians the tools needed to make sound, accurate differential diagnoses and to treat the patients effectively based on this decision making process. In order for students to gain the skills of clinical decision making and critical thinking, more than mere lecture and classroom discussion must be utilized. In her discussion article, McGinty (2000) proposed that case-based teaching and learning fills the educational needs of these increasing demands and responsibilities by effectively teaching content, but also by teaching the process of clinical decision-making and promoting lifelong learning. Like McGinty, I believe that case-based pedagogy meets the needs of physical therapy curricula in preparing physical therapy students to enter the profession.

In the *2007-2008 Fact Sheet of Physical Therapist Education Programs*, an educational report published by the APTA (May, 2008), only 1% of the physical therapy schools in America claim to use case-based learning as their main source of delivering content at the program level, and another 1.5% claim to use problem-based learning as the main delivery method. 4% of the programs reported having a modified problem-based curricular model that utilizes more traditional teaching methodology early in the curriculum and more of a problem-based format in the later stages. It can be assumed from the discrepancy in terminology between CBL and PBL mentioned before that cases are a large portion of the curriculum of 6.5% of the physical therapy education programs. Another 60.6% reported using a hybrid curricular model but the report does not describe how many of these utilize case-based methodology as part of their mixed curriculum. An unpublished survey conducted by the researcher revealed that of the

23% of physical therapy schools in America that were represented in the study (n=44), 100% reported using case-based instruction at one level or another in the course of study of their programs. The present research project targeted a sample of these schools identified in the survey for further qualitative analysis and evaluation of their utilization and implementation of CBL in their curricula by observing CBL activities in the classroom and interviewing students, faculty, and administrators. I also studied the perceived effectiveness of CBL in assisting in the delivery of physical therapy content by physical therapy students, faculty, and administrators through interviews. Through analysis of this data I hope to gain a better understanding of the use of CBL in physical therapy curricula.

Limitations of the Present Study

One of the major limitations of this study dealt with the selection of schools to be included in the study. As stated previously, a pilot study survey was performed by the author that surveyed program administrators of almost one quarter of the physical therapy schools in the nation. This survey was conducted at a national meeting and although the response was very good, 75% of the schools in the nation were not represented and thus not considered in this study. The pilot survey ascertained the general utilization and implementation of CBL in these schools as well as identifying schools that would be interested in participating in this qualitative study. Thus, the schools that participated in the study were selected purposefully based on their level of implementation, their reported willingness to participate, and their geographical proximity to other academic programs that met these criteria. In order to diminish the effect of this limitation, I studied a large enough group of schools to increase the amount of representation.

Another limitation of this study dealt with my own subjectivity as the researcher. I have been utilizing CBL in the classroom at differing levels since I began teaching in physical therapy in 2002. I am presently the chair of my department's curriculum committee and as such helped to devise and implement a new curriculum for our doctor of physical therapy program that is heavily case-based at a program level. I am presently involved in efforts to expand into inter-professional case-based learning experiences within our school. I am a strong advocate for the use of case-based learning in the classroom and I have my own ideas as to how it is best implemented and utilized. Thus, I have had to constantly realize and observe my own subjectivity and strive to be objective in data collection and analysis. To help alleviate the effect of this limitation, I maintained a field journal for data analysis and researcher subjectivity, utilized paraphrasing and restating during the interviews to assure that the participants' personal thoughts and beliefs were understood correctly, as well as multiple other methods for assuring reliability and validity to be discussed later in the methods section. Even though these few limitations may exist in the research methods and design, through the findings of this study, I hope to determine multiple factors that influence the use of CBL in the physical therapy classroom and expand the current body of knowledge in the realm of physical therapy education as it pertains to the use of CBL in physical therapy curricula.

Chapter Two

Review of the Literature on Case-based Learning

Much literature has been produced discussing the use of case-based learning in the classroom of multiple disciplines; however, not much evidence exists regarding the use of this methodology in physical therapy curricula. The purpose of this literature review is to present an in depth review of the existing literature found describing the multiple issues of utilization and implementation, as well as present findings of the effectiveness and limitations of case-based methodology. Ultimately, I plan to demonstrate that while much literature exists regarding implementation and utilization issues within multiple disciplines, the present study would add to the body of knowledge regarding the use of CBL in physical therapy curricula specifically.

A thorough search of the literature was performed utilizing multiple databases including Academic Search Premier, CINAHL, ERIC, Health Source: Nursing/Academic Edition, and PubMed. Database thesaurus and subject heading searches were utilized in order to determine the appropriate key words to search for. Key words searched included “case method”, “case-based teaching”, “case-based reasoning”, “case-based learning”, “problem-based learning”, “vignettes”, and “physical therapy”. Only seventeen articles were yielded by cross-referencing all of the former terms with the discipline of physical therapy. Thus, the key words “allied health education”, “nursing education”, and “medical education” were added to the search producing well over 500 articles. Out of these articles, only those dealing with issues of implementation, utilization, and effectiveness of case-based learning (as defined by Barrows) were reviewed for inclusion in this review.

Since there exists a discrepancy between the terms *problem-based learning* and *case-based learning*, articles are included that discuss problem-based learning but still fill the requirements of case-based learning as defined by Barrows. Only research articles were included, excluding all discussion and editorial type papers. Further research papers were found by reviewing primary resources cited in the papers found utilizing the search methods above. The results of the overall search produced seventy articles which met the inclusion criteria described above. Since a small number of articles have actually been published looking at CBL in the health sciences, a majority of the literature discussed within targets PBL. As stated earlier, only those articles discussing the use of clinical cases for learning are included though. Since not much literature exists looking at CBL or PBL in physical therapy curricula, a majority of studies presented deal with medical school implementation, utilization, and effectiveness since this is where a majority of the literature on PBL exists in the health sciences.

Implementation of Case-based Learning

Here I provide a very brief analysis of the literature regarding implementation of case-based learning at the program, course, and interdisciplinary levels. Most of the research that has been done on implementation has been at the program level. The bulk of this literature will be presented in great depth in the section of the literature review regarding effectiveness of case-based learning.

Program Level Implementation

Case-based learning is implemented within educational environments at many different levels ranging from the presentation of singular content to an interdisciplinary school-wide implementation. In the field of physical therapy, educational courses fall into a few major

categories; foundational sciences, clinical application, and clinical internships in the field. Foundational science courses include gross anatomy, human physiology and pathophysiology, biomechanics, kinetics, kinematics, and medical ethics among others. Clinical application courses deal with the diagnosis and management of different patient populations, administration, and courses dealing with evidence-based practice. The clinical internships are actual patient interaction in a clinical setting under the direct supervision of a licensed physical therapist, most often not a member of the faculty. As stated previously, it can be assumed from the discrepancy in terminology between CBL and PBL mentioned before that cases are a large portion of the curriculum of 6.5% of the physical therapy education programs.

Foundational courses. Foundational courses have commonly been taught utilizing traditional lecture or guided discussion methods. Cliff and Wright (1996) described implementation of case-based methodology in anatomy and physiology courses in order to deepen students' understanding of the basic material presented. A large majority of the representative sample of students reported that the utilization of case-based learning was a useful tool in that it decreased the complexity of the subjects for them and increased their understanding, appreciation, and curiosity of the subject matters. The average examination scores of the students significantly increased ($p < .05$) as well demonstrating that the implementation of cases was at least an equal if not better tool for presenting this basic science material. Peplow (1996) found similar positive findings in both student perceptions and performance with the implementation of CBL in his gross anatomy course for 2nd year medical students. Another study described positive outcomes seen in student perception and knowledge base with the implementation of an electronic case data base program in a basic

sciences genetics course. Through this project students were able to make connections between genetic testing and psychosocial and ethical considerations. Through the use of contextual cases, students were able to see a direct bridge between the basic science and its application in real world contexts (Lundebergh et al., 2002). The same benefits can be gained in physical therapy educational programs by incorporating cases into the foundational science courses. Not only could it increase the students' knowledge and understanding of the material, but by introducing them to the case methodology early on, one can instill the clinical decision making process, which is so important to physical therapy practice.

Clinical internships. Traditionally, when students are attending clinical rotations, there is minimal communication between the school and the student. While students are in the clinical setting they are actively participating in the treatment and management of actual patients. It may be argued that this is the ultimate experience of case-based learning. However; due to the great amount of diversity in clinical sites, patient populations, learning styles of the students, and teaching styles of the clinical instructors, not much consistency exists in the experiences of these students. Tichener, Davidson, & Jensen (1995) describe a method of incorporating the case-method into a physical therapy residency program. Even though this model describes implementation in a post-graduate setting, it could be appropriate for the clinical internships in an entry-level program. Basically, the clinical instructor uses real-life cases that the student is being exposed to and works through them in the similar format that would be done in the classroom setting with stimulus questions and stated objectives. The difficulty in this scenario would be the training of clinical instructors to teach students in this format.

Shokar, Bulik, and Baldwin (2005) describe how they used a web-based learning environment to integrate case learning in a family medicine rotation for medical students. They offered this as a way to supplement to students' internship experiences and increase consistency between what students are learning on their rotations. This could be combined with the case-building technique described by Ryan and Marlow (2004) where physical therapy students would be responsible for creating cases based on their own experiences to present to the class through a web-based medium. Classmates would then have to work through these cases just as they would if they were in the classroom setting.

Interdisciplinary Implementation

The case methodology has also been implemented at a school-wide level where multiple disciplines are given the opportunity to work through the same case from their respective perspectives. The use of case-based pedagogy in interprofessional learning environments has been introduced by numerous authors (D'Eon, 2004; Lindqvist, Duncan, Shepstone, Watts, & Pearce, 2005). In the allied health professions, this could be developed so that physical therapy students would work in teams with students from medicine, occupational therapy, speech therapy, nursing, and other fields to work through cases from these multiple perspectives. It would be possible to develop somewhat of a learning community within the school tied together through the use of cases. Matthews, Smith, MacGregor, and Gabelnick (1997) describe learning communities as "conscious curricular structures that link two or more disciplines around the exploration of a common theme." Not only do the students learn about didactic content presented in the case, they also learn about other disciplines as well as learning group dynamic skills from working with such a diverse group of individuals. Physical

therapy programs are often housed within larger schools and health science centers where multiple disciplines are taught allowing fertile ground for interdisciplinary educational opportunities with other healthcare fields.

In a study by Curran, Sharpe, Forristall, & Flynn (2008), the researchers teamed together students from medicine, nursing, pharmacy, and social work to work collaboratively on six separate case scenarios over a two week time span. The case-based learning experience offered both face-to-face and asynchronous on-line learning environments in which the students were able to collaborate. The findings showed that the students greatly preferred the face-to-face module because of the opportunity for interdisciplinary teamwork that it offered. Another study presented findings from a controlled trial where participants volunteered to participate in an interdisciplinary case-based learning experience including students from medicine, midwifery, nursing, occupational therapy, and physical therapy (Lindqvist, Duncan, Shepstone, Watts, & Pearce, 2005). The researchers analyzed findings from student evaluations (85% response rate) and found that 100% of the respondents reported that they would like to be involved in future interdisciplinary modules. 94% reported that working together as a group was helpful and 85% reported that they worked well together with the other members of their team.

Utilization of Case-based Instruction

The mere implementation of case-based pedagogy alone doesn't guarantee all of the benefits described in the previous section. The cases must be utilized in a correct and effective manner. John Dewey describes this best in the following quote:

Mere activity does not constitute experience. It is dispersive, centrifugal, dissipating. Experience as trying involves change, but change is meaningless transition unless it is consciously connected with the return wave of consequences which flow from it. When an activity is continued into the undergoing of consequences, when the change made by action is reflected back into a change made in us, the mere flux is loaded with significance. We learn something (Dewey, 1916, p. 139).

Multiple resources exist in the literature addressing the utilization of case-based teaching techniques in the classroom. There are numerous different aspects of developing and utilizing case-based methodology that must be taken into consideration when introducing the use of cases into a course or program. This review will present findings in the literature that describe effective utilization of case-based pedagogy in four major areas: the format of the case utilized, the structure of the case-based learning experience, the medium of delivery of the case-based learning experience, and the facilitation of the case-based learning experience.

The Format of the Case Utilized

A few considerations need to be made when creating a case, regardless of the format utilized. One of these is whether the case should be more directed or open. Cliff and Wright (1996) described implementation of directed case studies. These cases are written in such a fashion as to direct the learner to the correct answer or action. The stimulus questions asked regarding the case used are directed in that they are looking for the correct answer for each one. This presents more of a behavioral approach to the use of cases as opposed to a constructivist one; however, it may be very effective depending on the course and content

being covered. Cliff and Wright were utilizing this method in an anatomy and physiology course which is a foundational course focused on having students learn and memorize terminology and specific processes. An open case study would have more than one, and usually many, possible options for the learner with open ended questions aimed at understanding the thought process of the individual as opposed to searching for one correct answer.

Cliff and Wright also offered four features of good case studies that were consistent with most other suggestions found in the literature including “1) defined, inclusive learning objectives; 2) an informative, engaging case scenario; 3) pertinent, didactic questions; and 4) information needed to answer the case questions is readily available to students.” D’Eon (2005) suggested that the cases be designed such that they require students to “plan, act, observe, and reflect.” They also suggested that cases should be sequenced within a semester in such a way as to increase complexity over the course of the semester. This could be done by starting with easy cases and increasing complexity by scaffolding information with each consecutive case. Ellis et al. (2005) stressed the importance of good association between case content and knowledge level of the learner in order for the learner to be able to meet the stated objectives.

Many different variables exist in formatting of case-based learning experiences including the type of case used. VanLeit (1995) describes four different types of patient cases that can be used in allied health professions. These include fabricated written patient cases, real or mock patients who have been videotaped, actual simulated patient cases with either classmates or standardized patient actors, and real patient cases. Even though learners gain much through interaction with an actual patient, the scenario and outcomes of the case experience are

difficult to control. The use of live patients can be easily implemented in most physical therapy programs as clinical education agreements are already set up, and clinicians are often interested in aiding the educational process in this manner. The most common case formats found in the literature and described below are: paper cases, video cases, and simulated cases through both patient simulators and standardized patients.

Paper cases. When discussing the format of case-based learning, the most commonly utilized would have to be the paper case. Here cases are either created from scratch or adopted/adapted an existing case to meet the learning objectives of the case-based learning experience. These cases are typed vignettes with varying amounts of case information that can be sent or made available to the learner along with stimulus questions to help guide the learner through the case. One of the most time consuming components of case-based teaching in the classroom is the development of cases. This may be unnecessary, however, if you can find a suitable source for prefabricated cases for your content. Most textbooks now include case studies either within the chapter, in the appendices, or in a teaching manual to go along with the textbook. Different books also exist in multiple disciplines which offer prefabricated case studies that may be utilized or adapted to fit the needs of your individual classroom. One such book in physical therapy is *Clinical Cases in Physical Therapy* (2nd ed.)

Many useful sources exist on writing case problems for utilization in classrooms of multiple disciplines. Herreid (1994) described numerous sources that could be utilized to create cases on your own including actual events in the media, adapting cases written from other authors, and adapting cases from real life experience of the individual. In physical therapy education, these sources are numerous. Case studies are often presented in the

journals of the profession as well as journals of other health professions. Many physical therapy faculty members also treat patients and can adapt actual patient cases to be used in the classroom. Clinical faculty may also be trained to create cases and this would be one more way of incorporating those individuals in the community who are interested in helping with teaching. Herreid does discuss the benefit of creating a case from scratch, however, in order to incorporate all that is intended to be included in the content by the instructor.

Ryan and Marlow (2004) describe a program that has the learners actually develop the case themselves. They identified how this process was a learning experience and may be beneficial for the learners. They implemented this in a continuing education course for present medical practitioners and may not be appropriate for first or second year entry-level physical therapy students. However, it may be a good learning tool for third year students who have completed multiple clinical rotations and have had a multitude of patient experiences. This then may become a source for further case studies by adapting them for use with first or second year physical therapy students.

Neistadt, Wight, and Mulligan (1998) performed a qualitative study looking at the use of specific paper cases they designed as clinical reasoning case studies in occupational therapy curricula. They found that through the utilization of these cases that students felt as though they demonstrated better understanding of clinical reasoning as well as higher quality intervention plans and higher levels of confidence in their abilities to develop these intervention plans. Gentner, Lowenstein, and Thompson (2003) performed a series of studies looking at the impact of the use of two similar yet different paper cases or vignettes presented at the same time on transfer of learning. They found that there was a significant increase

($p < .05$) in the amount of transfer of learning (schema for problem-solving and understanding of basic principles) applied to a new and unique case for those learners who had learned through case comparison versus those who learned through individual case presentations. As paper cases are the gold standard of case format, they are also discussed in the next few sections through comparison to other methods and formats.

Video cases. The video case is an excellent format for students to truly be able to see the context of the case as well as the signs and symptoms of an actual case presentation. These videos may be procured through a number of ways. One could purchase video cases from a vendor; one could record video of a mock case presentation; or one could record video of an actual patient interaction with the approval and consent of the patient. Balslev, De Grave, Muijtjens, and Scherpbier (2005) utilized structured observations to compare the use of video case vignettes and paper case vignettes on the learning qualities of data exploration, theory building, theory evaluation, and metareasoning. They found that in the verbal clauses recorded during case discussions of participants that the numbers of clauses representing all of these areas were significantly greater in those students who had the video vignette versus those with only the paper vignette. Chau et al. (2001) looked at the effects of using video case vignettes in nursing on both knowledge and critical thinking. A pre-test/post-test design was used and mixed findings showed that there was a significant increase in knowledge of the learners after the case intervention, but there was no statistically significant differences in critical thinking as measured with the California Critical Thinking Skills Test.

Simulated cases. Although video cases may be able to provide the learner with a true image of the patient, they do not allow for any level of interaction between the learner and the

patient in the case. Two formats described in the literature allow this kind of interaction through the utilization of simulated patient cases. One of these formats is the utilization of standardized patients. These are either lay people or others trained to role-play a specific patient case or diagnosis for health care providers to practice their skills of evaluation, interaction, and intervention upon. Panzarella and Manyon (2008) described the use of standardized patients specifically for the education of physical therapy students. The focus of this study was looking at this tool as a way to assess the clinical competence of students prior to their clinical rotations and true patient interaction. Specifically the students were assessed in four areas including history taking, knowledge integration, physical examination, and overall quality of the clinical interaction. They found no significant difference between the mean scores of different raters and found high correlation coefficients demonstrating high levels of interrater reliability between the ratings of expert clinicians and those of the criterion rater. Even though they were utilizing this format of cases for assessment purposes, they discussed the benefit of the overall learning experience attained through interviews with both the faculty and learners involved.

The advent of new technology continues to offer more advanced ways of simulating patient encounters. Many medical schools and other educational programs in healthcare are now utilizing human patient simulation. These human patient simulators are high-fidelity mannequins that can mimic real life patient scenarios. They have palpable pulses in all of their extremities, breath, sweat, blink, and even have the capacity to speak through internally placed speakers. Students are able to interact with these mannequins in specially developed case-based learning experiences.

One study compared traditional case-based learning with that of human patient simulation for a specific content area through a randomized controlled trial (Schwartz, Fernandez, Kouyoumjian, Jones, & Compton, 2007). The researchers looked at student performance on a chest-pain specific objective structured clinical examination (OSCE) and found that there was no statistically significant difference between any of the three subsets of the OSCE (history, acute myocardial infarction management, and cardiac arrest management). The fact that there was no significant difference in the exam scores of either group of learners demonstrates that paper cases are viable options for programs that do not have such high fidelity simulators at their disposal. The researchers did discuss the multiple benefits of training on the human patient simulators though, including the ability to perform tasks that a student couldn't ethically perform on a well human actor.

The Structure of the Case-based Learning Experience

Another variable to consider in the utilization of case-based learning is the structuring of the case-based learning experience. The learning experience can be structured where the learner works through the case independently or in collaborative group settings. Many authors describe the benefit of collaborative group efforts when implementing case-based learning (D'Eon, 2005; Kunselman & Johnson, 2004; McKeachie & Svinicki, 2006). It is more difficult to assess students individually when they are working in a group setting; however, they gain much more through the interaction with peers in the process. Due to the collaborative nature of the health care arena, it is very beneficial for physical therapy students, as well as other healthcare professionals to gain skills in group dynamics throughout the curriculum. The three most

common structures found in the literature were small group discussion, large group lecture and discussion, and bedside or clinical teaching.

Small group discussion. The most common PBL or CBL instructional structure utilized is small, collaborative group learning. Utilizing qualitative data collection techniques of interviewing and questionnaires, Tara Fenwick (2002) looked at the utilization of small group PBL/CBL structures compared to other methods within the academic program for organizational leadership of mid-career professionals. Not only did the participants of the study demonstrate a strong preference for small group problem-based learning, they also reported it as having the strongest influence on their long-term learning as professionals. Aside from individual learning about the content, the participants also listed gaining a greater understanding of group dynamics and process, increased ability to appreciate different perspectives, and systematic thinking as the most beneficial gains through the implementation of small-group PBL/CBL structures. Steinert (2004) performed qualitative focus group interviews with 1st and 2nd year medical students to find out the characteristics that they felt led to effective small group learning. The consensus from the focus group interviews was that effective small group learning required effective facilitators, a positive atmosphere, strong group interaction and participation, clear goals and adherence to goals, relevant and integrated cases, and promotion of critical thinking and clinical problem solving.

David Irby (1994) performed a qualitative study looking at three different methods of structuring the case-based learning experience including small group discussion, large group lecturing, and bedside teaching. He performed an ethnographic study where he immersed himself in the clinical teaching of three different professors who had been identified to be in

the top ten ranked professors of a medical school with over 300 members of the medical faculty. He performed numerous interviews and observations to gain a full understanding of the teaching techniques. He concluded that all three instructors followed five common principles that were consistent with experiential learning theory. These included the instructors' focus of instructing through cases, their ability to actively engage the learner, and their focus on modeling critical thinking and clinical problem solving, providing adequate and appropriate feedback and direction, and create a collaborative learning environment. Irby demonstrated that regardless of the structuring of the learning environment, these principles were what led most to the quality of the learning experience and should be followed in all learning structures.

Large group lecture/discussion. In many health science disciplines, class sizes are too large and resources are too limited to facilitate numerous small groups within one large class. This has been one of the common barriers to utilization of CBL discussed earlier in this paper. As described in the research by Irby (1994) in the previous section, CBL can be effectively used in large group lecture formats. Other research has looked at utilization of CBL in large group formats compared to that of the traditional small group format (Roberts, Lawson, Newble, Self, & Chan, 2005). These researchers performed a randomized controlled trial where they divided learners into traditional PBL groups and small groups facilitated in a large lecture hall setting by only a few expert facilitators. They looked at knowledge acquisition, the quality of student group performance and presentation, and student evaluation of the learning experience. The researchers found that there was no significant difference between the two groups with respect to knowledge acquisition and student performance and presentation. However, based

on the findings of the student evaluation of teaching feedback, the students demonstrated a stronger and statistically significant preference for the traditional small-group problem-based learning format compared to the large group facilitation format. The findings of both this and the Irby study suggest that if the class size is too large and the number of small-group facilitators is limited that PBL and CBL activities can be beneficial and effective in large-group settings even though they may not be as liked by the learners.

Bedside teaching. Traditionally, when students are attending clinical rotations, there is minimal communication between the school and the student. While students are in the clinical setting they are actively participating in the treatment and management of actual patients. It may be argued that this is the ultimate experience of case-based learning. However; due to the great amount of diversity in clinical sites, patient populations, learning styles of the students, and teaching styles of the clinical instructors, not much consistency exists in the experiences of these students. Tichener, Davidson, & Jensen (1995) describe a method of incorporating the case-method into a physical therapy residency program. Even though this model describes implementation in a post-graduate setting, it could be appropriate for the clinical internships in an entry-level program. Basically, the clinical instructor uses real-life cases that the student is being exposed to and works through them in the similar format that would be done in the classroom setting with stimulus questions and stated objectives. The difficulty in this scenario would be the training of clinical instructors to teach students in this format. Shokar, Bulik, and Baldwin (2005) describe how they used a web-based learning environment to integrate case learning in a family medicine rotation for medical students. They offered this as a way to

supplement to students' internship experiences and increase consistency between what students are learning on their rotations.

O'Neill, Morris, and Baxter (2000) studied the implementation of a small group case-based learning experience during a clinical clerkship for third year medical students. They did this through developing two separate modules that were facilitated by the students' clinical teachers in the clinical setting. They analyzed student evaluations and surveyed the clinical tutors to gain an overall understanding of the effectiveness and efficiency of the program. Of the students polled, greater than 50% agreed or strongly agreed that the case-based learning experiences stimulated their learning, increased their motivation to learn, allowed them to link clinical experience with other knowledge, and overall helped with their learning. Of the facilitators that were polled, 97% reported being happy with their role as tutor and 93% agreed that they would suggest the role to a colleague. As iterated by the Irby article (1994), all three structures of case-based learning experiences presented here are viable options for utilizing CBL in a clinically oriented curriculum. The key in deciding which is the best is that one must appropriately match the situation and needs of the learner with the resources available of the learning environment.

The Medium for Delivery of the Case-based Learning Experience

Traditionally, there was only one medium for delivery of the case-based learning experience, this being a face-to-face educational interaction. As the technological age moves forward, many new advances have been developed to allow for computer-based case presentations and learning experiences. Many authors describe the use of computer programs for working through case-based problems. Even though this is starting to become a more

widely used medium for the presentation of case-based learning experiences, face-to-face environments are still the most commonly utilized. Many issues exist regarding the use of technology in case-based pedagogy. Cost and accessibility presents as a major issue with case-based pedagogy. Online learning environments are costly and development of programs for case-based techniques can be time consuming and costly as well. Learners' accessibility to computers and the Internet has to be taken into consideration before utilizing web-based programs. Aside from the traditional face-to-face medium, hybrid learning experiences as well as synchronous and asynchronous on-line experiences will be discussed.

Hybrid case-based learning experiences. Two studies identified examined a hybrid class design with aspects of computer-based on-line case application mixed with episodes of face-to-face classroom or small-group discussion. Ellis, Marcus, and Taylor (2005) found that the on-line environment seemed to be as beneficial to the students as the face-to-face portion of the case as long as strong connections were made between the two. If the students perceived the two environments to be minimally correlated the students' learning was negatively affected. Chen, Shang, and Harris (2006) found positives and negatives of both methods in the hybrid setting. The on-line portion of the course was more convenient for the students and created increased extrinsic motivation compared to the face-to-face environment, as the instructor could track student participation on-line. However, the face-to-face environment was found to be much more effective in the learning of complex and difficult issues compared to the on-line environment. Both groups of authors suggest an appropriately designed hybrid use of technology as the most effective method of the use of computers in case-based pedagogy.

Synchronous and asynchronous case-based learning environments. When discussing on-line learning environments, there are two major types, synchronous and asynchronous. In synchronous learning environments all of the learners and facilitators are on-line at the same time and are interacting with each other in real time. With asynchronous learning environments, the learner is given the freedom to participate at a time most convenient to them and is not required to be on at the same time as other learners. Both of the learning environments in the articles presented in the previous setting were asynchronous settings. This is the most common on-line environment used and reported in the literature. Hayward and Cairns (2001) performed a study on the utilization of an on-line, asynchronous case-based learning experience in delivering content in a physical therapy curriculum. The researchers provided cases electronically and had students work in groups through an on-line asynchronous environment to answer stimulus questions and create a case report to present. They presented the findings of an evaluation survey completed by the participating students and found that overall the learners felt very strongly that the on-line learning environment made communication with instructors and classmates easier, was more valuable and effective than traditional ways of learning, and the learners preferred the internet case assignments and computerized cases over other methods and alternatives.

Dennis (2003) on the other hand, investigated a synchronous learning environment through the utilization of chat rooms and compared it to traditional face-to-face environments with regards to knowledge acquisition, time-on-task, and student generated learning issues. The author found that there was no significant difference between the exam scores of the students in the face-to-face and synchronous on-line learning environments. He also found

that the students in the synchronous on-line learning environment spent 23% more time on task than the students in the face-to-face learning environment. Whereas, increased time-on-task is usually a good outcome, when it is coupled with no change in learning outcomes the opposite is true. This would denote that there was a lack of efficiency with the synchronous learning environment as compared to the face-to-face environment. Many times, technical problems interfered with the usage of chat rooms and other technology may be counterproductive in the learning experiences. These issues may not always be so counterproductive in asynchronous learning environments, but still exist none the less.

The Facilitation of the Case-based Learning Experience

The role of the facilitator presents as another aspect that is different between case-based and problem-based learning by definition. In problem-based learning, the facilitator takes a very passive role and mostly observes the learner or learning group as they guide themselves through the different aspects of the case. In case-based learning, the facilitator takes a much more active role and actually assumes some of the responsibility of guiding the group through the case (Srinivasan et al., 2007). The facilitator thus takes on a dual role as one of the group members and as the evaluator for the performance of the group. One area of argument in the literature is whether or not the facilitator should be an expert in the field or if they just need to be knowledgeable about teaching with case-based techniques. Hay and Katsikitis (2001) found that students who were paired with a facilitator who was an expert in the field performed significantly better ($P < .001$) on examinations than students paired with a regular tutor (72.5% and 57.9% respectively). Langenberghe (1988) suggested that the facilitator need not be an expert in the field of physical therapy, however. He posited that “the

tutor's task is not the teaching of a specialized subject, but the facilitation of an appropriate and systematic approach to the problem." He does suggest that all tutors be trained in the method of the case-based teaching being utilized. Gilkison (2003) performed qualitative observations of case-based learning experiences facilitated by both expert and non-expert tutors. The author described that there existed many similarities between the teaching characteristics of the two different tutors. However, a few major comparisons the observer did notice were that the expert tutor would often be the one to pose stimulus questions to the group, whereas the non-expert facilitator would expect student peers to question each other. However, it was noticed that the non-expert tutor intervened in facilitating the group process more frequently than the expert counterpart.

Sequence of the experience. This is one of the major areas that delineate case-based and problem-based learning. In case-based learning, the students are given information about the case in advance as well as a list of resources that may help the student prepare for the experience. In problem-based learning the students have no prior knowledge of the case when starting the experience and are not directed to any resources to utilize (Srinivasan et al., 2007). Multiple authors describe the benefit of giving the learner an introduction to the content either through readings or classroom lecture or discussion before utilizing the case problems (Celenza et al., 2001; Cliff & Wright, 1996; Ellis, Marcus & Taylor, 2005). Once the learner has knowledge of the content, the case then demonstrates to them how this knowledge is applied in a real world situation. Other authors discuss the importance of educating the learners on the use of case-based methodology before initiating it for the first time in a course or program in order to assure that the learners gain everything from the case experience that is intended (Kunselman

& Johnson, 2004; McKeachie & Svinicki, 2006). Another method that has been used for this same purpose is that of modeling where the facilitator or a professional in the field works through a case first so that the learner can see how the case problem should be performed (Ellis et al., 2005; McKeachie & Svinicki, 2006). Another aspect of sequence that has been shown in the literature to be beneficial is allowing ample time following the case for reflection on the learning experience (D'Eon, 2005; Ellis et al., 2005; Irby, 1994). This reflection time gives the learner the ability to synthesize the overall meaning gained through the experience.

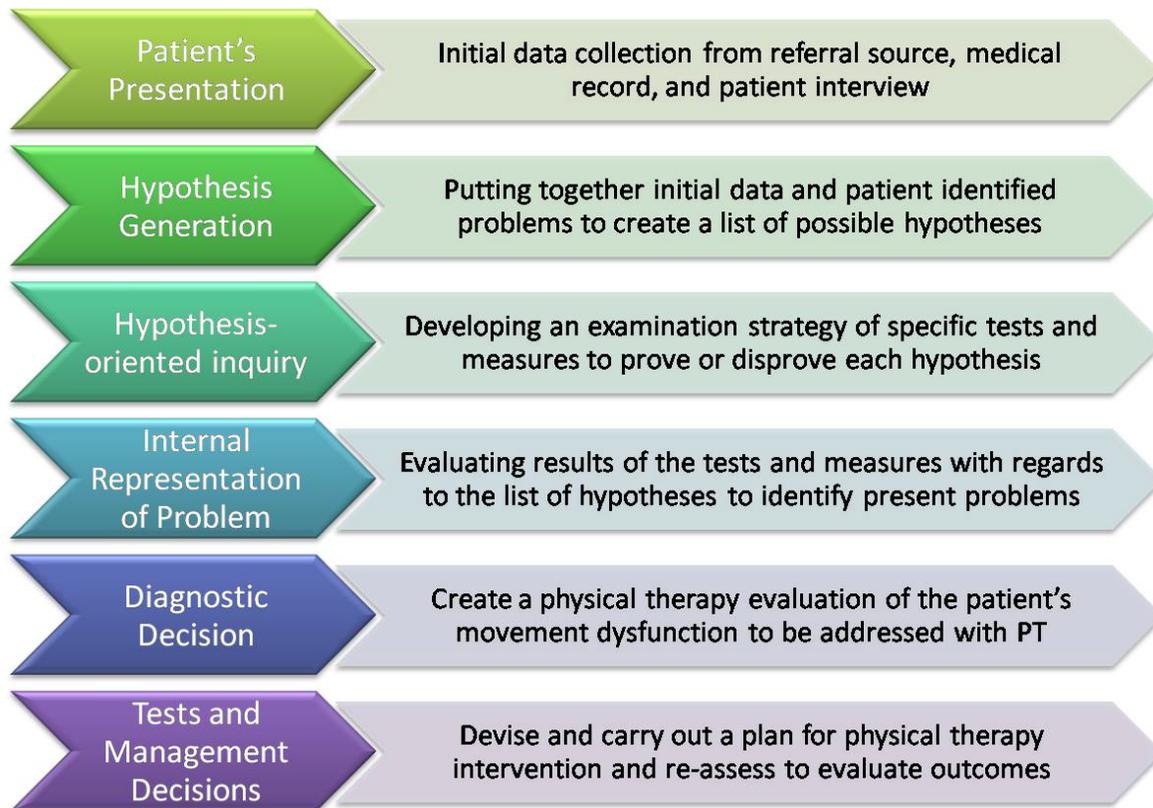
Effectiveness of Case-based Learning

The gold standard method of instruction in physical therapy schools, medical schools, and other health science programs has traditionally been lecture format. Therefore a majority of the research that has been done on the effectiveness of CBL and PBL has compared it to the effectiveness of traditional lecture format. When PBL began to gain its popularity in the 1970s and 80s, many educational programs were structuring their curriculum wholly around this methodology. Many traditionalists were very resistant to this change, especially as an all-or-none approach. In order to justify such a large shift in the paradigm of how to best present an overall curriculum, much literature was produced in this time looking at multiple aspects of health sciences education and many differing student outcomes. The major categories of student outcomes presented in the literature and discussed here include: clinical reasoning and decision-making/problem-solving, knowledge acquisition and retention, and clinical preparation and performance.

Clinical Reasoning, Decision-making, and Problem-solving

One of the main tenets behind the implementation of problem-based learning methods is its ability to develop and enhance the clinical reasoning skills of the learner (Schmidt, 1993). Barrows and Feltovich (1987) described a model for the clinical reasoning process in medical doctors frequently referred to as the hypothetico-deductive pattern. Figure 2.1 illustrates this clinical reasoning process as well as the model's application in physical therapy practice.

Figure 2.1 Clinical reasoning process applied to physical therapy practice.



Jones, Jensen, and Edwards (2008) describe three major requirements for clinical reasoning in physical therapy practice including knowledge of basic science and theory, cognitive skills of analysis and synthesis, and metacognitive skills of self-assessment and reflection. Much of the literature in the area of clinical reasoning looks at the transition from novice to expert thought

processes. Hmelo (1998) provides a summary description of the three main aspects of expert clinical reasoning that differentiates it from novice reasoning found in the literature. Expert clinical reasoning is essentially more accurate and efficient; their processes of differential diagnosis and problem generation are more coherent and comprehensive; and, their problem-solving process is driven more by knowledge and data than hypothesis-driven reasoning. The novice learner, without the knowledge and experience of the expert, must go through the full process of hypothesis driven reasoning with the advent of each new patient or problem encountered. Over time this process and knowledge becomes inherent and ingrained in the problem-solving process of the expert clinician. Boshuizen and Schmidt (1992) describe this process as *knowledge encapsulation*. The purpose of problem-based and case-based learning is to teach and model this hypothesis-driven clinical reasoning strategy to the pupil in order to initiate the process of encapsulation and move the learner towards expert thought while still in their didactic coursework.

Patel, Groen, and Norman (1991) performed a structured analysis of case-based discussion transcripts comparing the problem-solving patterns of students in a conventional medical curriculum to those of students in a problem-based curriculum. The transcriptions were chunked into student propositions made during the CBL experience and these were coded using a complex system of analysis focused on the source of the information the proposition was based on, the directionality of the proposition (forward or backward thought process), and whether the proposition was causal or conditional in nature. As stated earlier, clinical reasoning is a process of backward thought, or hypothetico-deduction, based on accurate information for causal-relational application. The researchers scored student propositions

higher that met these criteria. Through in depth analysis of the coded transcriptions, the researchers found a significant ($p < .05$) difference between the groups in directionality, accuracy and knowledge. Students of the PBL program utilized more hypothetico-deductive reasoning and tended to be more accurate earlier in their didactic preparation than their conventional curriculum counterparts.

A similar study was performed by Hmelo (1998) comparing students in PBL curricula and traditional curricula of two separate schools on the aspects of clinical reasoning; accuracy, coherence, comprehensiveness, and clinical reasoning. The author coded transcriptions of students working through a case as the previous study did and analyzed the student responses and thought patterns in each of the variables listed. She found no significant difference between accuracy of the PBL and non-PBL students, but did find that they increased in coherence significantly compared to their non-PBL counterparts ($p < .001$). The author also found that the PBL students were more comprehensive in their problem-solving ($p < .05$), as well as the fact that they used more hypothetico-deductive reasoning in their processes as the non-PBL students ($p < .001$).

In another study by Schmidt, et al. (1996), students from three different types of curricula, problem-based, integrative, and conventional, were compared on their ability to provide an accurate diagnosis with limited case information provided in a case vignette. The authors describe the integrative curriculum as being case-based with traditional instructional methods utilized as well. Through a 3x5 ANOVA they found that curriculum type had a significant effect ($p < .0001$) on diagnostic performance over the six years of the medical school programs. The integrated program performed better than the other programs in the second

and third years of the programs, the problem-based program performed slightly better than the integrated program in years four and five, and the integrated performed best in the year six.

Hayward and Cairns (1998) performed a qualitative, single-site case study investigating the utilization of case-based instruction in a physical therapy course. They performed a series of three interview sessions with eight students who were volunteer participants. The interviews were held before the case-based course initiated, midway through the course, and after the course had concluded. Their research focused on student perceptions of case-based learning as an instructional methodology with regards to the enhancement of learning, the development of problem-solving skills, the motivation of the learner, as well as many different aspects of case-based learning. With regards to clinical reasoning, they found that a majority (seven of the eight participants) of the participating students preferred case-based learning over traditional lecture. From analysis of their interview transcripts, they found that the students perceived that case-based learning enhanced their clinical thinking, their problem-solving skills, their ability to seek out new information, and overall led to deeper thought processing of the learners.

One study looked at the implementation of a problem-based learning course for the purpose of developing clinical reasoning skills in occupational therapy students (Scaffa & Wooster, 2004). The researchers utilized a pretest/posttest design using the Self-Assessment of Clinical Reflection and Reasoning (SACRR) as the outcome measure. The findings of the study showed a significant increase in the posttest scores of 11 out of the 26 items on the SACRR. These items dealt most with issues of theory utilization, utilization multiple data sources, hypothesis orientation, and critical appraisal of information. The total mean scores of the

posttest SACRR for the participants were significantly higher than the pretest means at a $p < .01$ level.

Knowledge Acquisition and Retention

In chapter 1, it was discussed that one of the more common criticisms of case-based and problem-based learning was that there was a decrease in the amount of time allotted to content coverage and, thus, limited breadth and depth of knowledge of the learner. This has been one area that has been studied thoroughly with regards to problem-based learning. One study compared the knowledge acquisition and clinical reasoning skills of students in a traditional podiatric curriculum with those in a problem-based curriculum (Finch, 1999). Through implementation and analysis of both multiple choice and essay exams, the author found that there was no significant difference in the scores of the multiple choice exam measuring biomedical knowledge alone, but did find that the PBL students did significantly better on the essay portion measuring clinical problem solving ($p < .0005$) and the overall combined scores of the exam ($p < .005$).

Many researchers have used national board examination scores to compare PBL and traditional curricula in their ability to impart knowledge on their students. Distlehorst & Robbs (1998) compared the scores on the United States Medical Licensing Examination (USMLE) Steps 1 and 2 of students from PBL and traditional programs. They found no significant difference between the scores of USMLE Step 1 of the two groups, but they did find that the PBL students USMLE Step 2 scores were significantly higher than those from the traditional curriculum ($p = .05$). He also reported that a statistically significant greater percentage of graduates from the PBL program graduated with honors and honorary society membership compared to those

from the traditional program, which are awarded for academic achievement. Richards, et al. (1996) also compared licensure exams of the National Board of Medical Examiners (NBME) Shelf Exam of students from PBL and traditional curricula. They found no significant difference in these scores either ($p=.80$). However, they also analyzed the students' ratings on clinical competency reports from their clinical supervisors. The students from the PBL program were rated significantly higher ($p=.0001$) on their amount of factual knowledge than those in the traditional curriculum. Whitfield, Mauger, Zwicker, and Lehman (2002) also found no significant difference in USMLE Step 1 scores of the students compared from PBL and traditional curricula. As a matter of fact, these authors found no significant difference between the two groups in factual knowledge or clinical reasoning on clerkship ratings either. Beachey (2007) compared the licensure exams of students from PBL and traditional respiratory therapy programs and found no difference in the licensure exam scores for these students either ($p=.866$)

Shin, Haynes, and Johnston (1993) attempted to measure knowledge retention and compare it in graduates from a PBL curriculum to those from a traditional curriculum. They devised an examination to test multiple aspects of biomedical and clinical knowledge. Overall, the graduates from the PBL program scored significantly higher on the examination ($p<.01$) suggesting that problem-based learning may lead to greater retention of knowledge than traditional, lecture-based learning. Even though there is little evidence here that students who attend programs that implement problem-based learning have any greater knowledge than those in traditional academic programs, there is no evidence in any of the literature to suggest

that students in problem-based learning programs do consistently worse with knowledge acquisition and retention than their counterparts in traditional curricula.

In the study by Hayward and Cairns (1998) described in the previous section, the researchers found that physical therapy students felt as though CBL increased their active participation in the learning experience. Edgar Dale (1948) described the impact that active learning strategies have on knowledge acquisition and retention through this introduction of the well known "Cone of Experience". This cone of experience presented multiple learning experiences on a continuum between passive and active involvement of the learner. He demonstrated how instructional methodologies required the student to be more active in the learning process led directly to increased knowledge retention of the content. Similar to that described by Dale, Hayward and Cairns (1998) reported that case-based learning increased students' intrinsic motivation and interest in the subject matter. They also described how the use of physical therapy cases in teaching required students to integrate content both previously learned and across concurrent coursework. All of these attributes were seen to enhance the overall learning and retention of the physical therapy content in the learner.

Clinical Preparation and Performance

As stated before, the development of clinical reasoning skills is a primary purpose and focus of implementation of case-based and problem-based curricula. Clinical preparation and performance in physical therapy, as well as other healthcare fields, relies not only on these reasoning skills, but also psychomotor, cognitive, and affective skills as well. Multiple studies have looked at the effect of problem-based learning on the acquisition of these clinical skills in preparing students for clinical internships, as well as assuming the role of a licensed healthcare

practitioner. In the study described above, Distlehorst and Robbs (1998) also looked at performance ratings of medical students in their third year clinical clerkships. They found that the students from the PBL curriculum were rated significantly higher on their overall clinical performance compared to those from the traditional curriculum ($p=.0028$). Similar findings were seen in another study described above by Richards et al. (1996). These researchers found that students from the problem-based curriculum were ranked significantly higher in all areas of their clinical rating scale including the ability to perform a patient interview and physical examination ($p=.002$), devise an accurate differential diagnosis ($p=.0005$), and organize and express clinical information ($p=.004$). Koffman, Portney, and Jette (1997) compared clinical ratings of physical therapy students from both traditional and problem-based curricula and found mixed ratings of clinical performance parameters between the students. Students from the PBL curriculum were rated significantly higher ($p<.05$) their ability to accept and respond to constructive criticism, accept responsibility for their own learning, and communicate in a professional manner. Students from the traditional curriculum were rated significantly higher ($p<.05$) in critical thinking and problem solving, expressing self in a clear manner, and acting in a multidisciplinary way.

The study by Hayward and Cairns (1998) also discussed how case-based learning helps to better prepare the physical therapy student for entry into the clinical setting. The students interviewed in their study perceived that case-based learning enhanced their ability to transfer knowledge from the classroom to the clinical setting. Additionally, they felt that it better prepare them to treat the "whole patient" rather than focus on a singular diagnosis. These students also reported a greater understanding of interdisciplinary care, improved

communication skills, and an overall increased confidence and level of comfort with interacting with patients and other health care professionals in physical therapy practice.

Summary

Case-based methodology has been a very popular instructional tool in multiple disciplines throughout history. Case-based methodology is currently used in many physical therapy programs across the nation, mostly at the individual course level. This literature review presented the existing evidence on the implementation, utilization, and effectiveness of case-based and problem-based learning in multiple disciplines and tied this evidence to its implementation in physical therapy curricula. Further research needs to be done in the field of physical therapy education looking at the implementation, utilization, and effectiveness of case-based methodologies in physical therapy curricula.

Chapter 3: Methodology

Introduction

This study was aimed at gaining a better understanding of the level of implementation of case-based learning in selected physical therapy programs throughout the United States. I was also interested in identifying the existing factors that are consistent with effective utilization and implementation of CBL in physical therapy programs. Little has been done in studying the utilization and implementation of case-based learning in physical therapy. Since physical therapy is such a unique discipline, and since there is such variation in the way different programs present and carry out their curricula, I decided that the best methodology to use in this study was a qualitative, evaluation research design. In this study I utilized many qualitative data collection methods to study the use of case-based teaching in numerous physical therapy schools across the nation. I was also interested in finding the perceived effectiveness of this instructional methodology by physical therapy students, faculty, and administrators.

Research Questions

Three main research questions were investigated in this study including:

- To what extent are the selected physical therapy programs studied utilizing CBL in their curriculum and what different ways are they formatting, structuring, and applying CBL in the classroom?
- What are the factors that impact the effectiveness of implementation of CBL and what indicators exist that denote effective implementation of CBL in the selected physical therapy curricula?

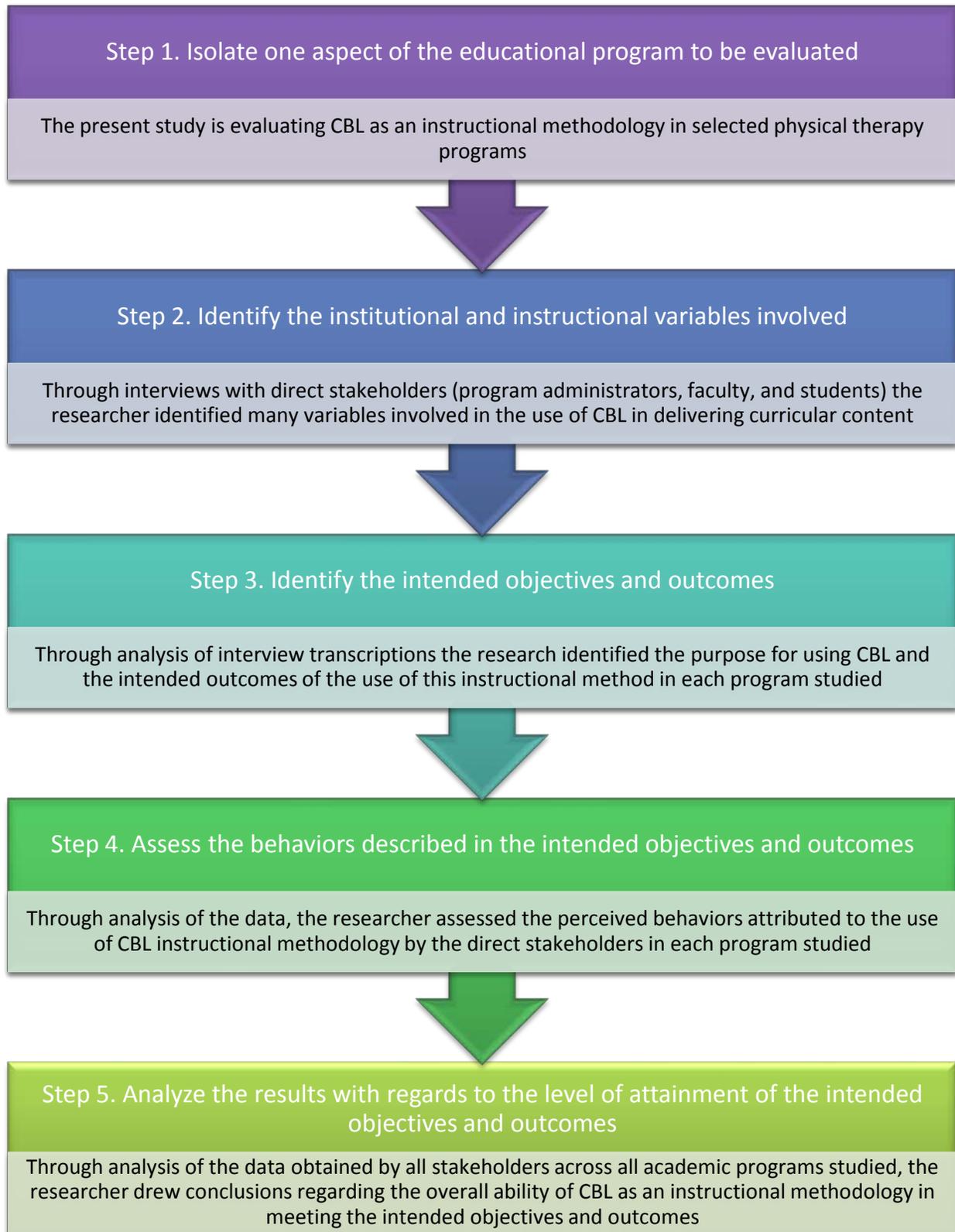
- What is the perceived effectiveness of CBL in delivering physical therapy curricula by physical therapy students, faculty, and administrators of the selected physical therapy programs?

These questions are best answered through qualitative methods and would be difficult to quantify even though quantitative studies may follow this to measure the extent and effectiveness once indicators have been identified.

Evaluation Model

For the purposes of this study, I chose to implement a variation of the Hammond's Goal-Attainment model for program evaluation due to the fact that I am studying the evaluation of a single instructional methodology in multiple programs and not a full program evaluation of any particular academic program (Popham, 1993). Figure 3.1 illustrates the five main components of Hammond's model as it is applied in this research study. As stated previously, little investigation has been performed into the use of CBL in physical therapy curricula and thus more inductive inquiry was called for in the design of this evaluation research study. Due to the inductive nature of the inquiry, I decided that a fully qualitative evaluation would be the most effective research methodology to utilize in this study. From my own experience with case-based learning and instruction in physical therapy, I assumed that many of the intended objectives and outcomes of using CBL were qualitative rather than quantitative in nature. When describing and defining the institutional and instructional variables involved, I believed it would be important to physically see and observe the setting and speak with the individual stakeholders to gain the best understanding of these specific concepts. Thus, a full qualitative

Figure 3.1 Hammond’s Goal-Attainment Model as it is utilized in the present study



evaluation research methodology utilizing in-person site visits was selected to utilize in this study as opposed to questionnaires were telephone interviews.

Role of the Researcher and Researcher Subjectivity

I am interested in the topic of case-based learning in physical therapy curriculum for numerous reasons. I have served as the departmental chair of the curriculum committee in the Physical Therapy Department at the Louisiana State University Health Sciences Center – New Orleans for the past five years. In this role, I have implemented a number of case-based learning initiatives both in my own classroom as well as department wide instructional experiences. I have been teaching in physical therapy for eight years now and have utilized CBL in many different ways throughout this time in varying forms. I am a firm believer in this as a primary means for delivering physical therapy content due to the highly contextual nature of the instructional methodology and the aspects of professional education inherent in physical therapy preparation. The program where I am on faculty has recently implemented a Doctor of Physical Therapy program, and in doing so, completely overhauled the curriculum. Much of the new curriculum is case-based and problem-based in its nature. This is a significant change from the more traditional methods used before.

As is usually the case, change was difficult. Individuals held differing beliefs within the department of the appropriateness and effectiveness of the use of this instructional methodology. This first sparked my interest in the topic of case-based learning. Once I realized that there was not much literature looking at the utilization of CBL in physical therapy curricula, I became interested in what other schools were doing with methodology and how they were measuring its effectiveness.

In qualitative research, the researcher is the primary instrument of data collection and data analysis. As such, researcher subjectivity can and does introduce inevitable bias into the process of qualitative inquiry. To minimize this bias, I took numerous steps and precautions in both data collection and analysis. First, I created and utilized facilitator guides that had been reviewed and critiqued by a professional program evaluator with more than 20 years of experience in the field. I made conscious efforts in the selection and wording of my interview questions as to not be directive or leading. I also asked questions that would exhaust the contrary of many questions asked or topics discussed in the interviews. Throughout the interview process, I would ask the participants for clarification or restatement of discussion points in order to more clearly understand the participants' intentions and meanings while speaking so that their thoughts and ideas would be clearly and truly represented in the data. These different techniques were utilized in an effort to minimize researcher bias during the data collection process. I also utilized reflective journaling throughout the process of data analysis to be able to better understand the process by which I identified themes and drew conclusions in order to identify any possible bias that may have impacted the analysis of data and drawing of conclusions.

The overall role of researcher in this project was to coordinate the scheduling and perform the data collection for the numerous schools, as well as perform all data analysis. Even though I am a physical therapy faculty member, I did not consider myself a participant observer since I only observed case-based learning experiences without engaging in the process and performed one-on-one and focus group interviews. My presence possibly affected the interaction of the class of students due to the fact that I only performed one observation in two

separate programs. However, I minimized my interaction and disruption as much as possible to limit the amount of this interaction.

Research Design

As stated previously, I chose to use qualitative evaluation research methodology to answer the research questions posed in this study. In this section I will describe all of the components of the research design used including sampling procedures, establishing contact and gaining entry, data collection, and data analysis. I will also describe issues of trustworthiness, reliability, and validity of the research instrumentation.

Participant Selection

As of March 23, 2010, there were 212 accredited physical therapy programs across the United States (APTA, March, 2010). As stated previously, a pilot study was conducted by the researcher that surveyed administrators and faculty of 44 of these schools regarding the level of utilization and implementation of CBL in their curricula (Nelson, 2009). This survey was administered during a national convention and asked the respondents to denote whether or not they would be willing to be contacted for further qualitative inquiry into their usage of case-based learning techniques. The survey may be found in Appendix A for further reference. From the survey responses, purposeful sampling was utilized to identify schools that were to be evaluated in this research project. The inclusion criteria for selection of a school to be used in the study included first, the school must have denoted willingness to participate in the study on the pilot study survey. Secondly, they must have reported utilizing and implementing CBL in the classroom at a fair to moderate level on the surveys as well. I determined that a fair level of self-reported utilization and implementation of CBL on the survey was defined by at least one

response of at least a 2 (Often) on any of the seven items regarding utilization and implementation of CBL (items 2a. through 2g.). Finally, the sites chosen had to be in close proximity to other participating programs who also met the inclusion criteria one and two so that multiple sites could be evaluated in one geographic location. This inclusion criterion was based on the logistics and cost of performing in-person site visits utilizing a budget through a small grants program.

An application for expedited review was submitted to the LSUHSC-New Orleans IRB for approval since funding of this project came from the small grants program through the School of Allied Health Professions. The researcher also submitted the project to and received approval from the University of New Orleans IRB. Both of these IRB approval documents may be found in Appendix B. Once all research protocol changes were made and IRB approval was received, I began the process of selecting the academic programs to be contacted for request of participation in the study. As required by the IRB, only academic programs who had completed the aforementioned survey (Appendix A.) and reported interest in participation in the study by responding to item #3 with either a positive (yes, absolutely, etc.) or possible (maybe, possibly, etc.) were to be selected for initial contact. Only five of the 44 programs represented in the study answered “no” or similar negative responses to item #3 regarding willingness to participate in the study. Of those programs meeting this criterion, only one program did not use cases often enough to achieve the rank of fair implementation and utilization of CBL as described above. Thus, the selection of the academic programs to be contacted first in requesting participation was made based on geographic location and proximity to other programs. Based on project funding, I decided that at least three programs needed to be in

close proximity in order to be most efficient in my data collection. A map of the United States showing the location of all of the physical therapy programs in the United States can be found in Appendix C. Those programs with a red asterisk represent all of the programs represented in the survey sample. The nine programs with a red box around them denote the first nine programs that were to be contacted requesting participation in the study. In selecting the academic programs, I attempted to include geographic locations where a large percentage of academic programs were located in order to better represent the full population of physical therapy programs in the United States. Utilizing the research methodology described by Miles and Huberman (1994), I originally selected nine programs to study with the idea that I would be able to cease data collection once I had saturated my data and was identifying no new codes or themes. On the same note, if I performed all of the data collection at the nine academic programs selected and still had not saturated my data; I would go through the selection process again and visit more programs for data collection.

Initial Contact and Gaining Entry

Once the first nine academic programs were selected, the initial contact with the academic programs was made with the individual who filled out the program's respective survey. A copy of the letter requesting participation can be found in Appendix D. Once the academic program agreed to participate, the task of selecting individual participants in each school was performed by the contact person at the respective academic program. These individuals were instructed to use purposeful and convenience sampling by soliciting volunteers who utilize CBL in their respective programs. At each selected school, the participants were one or two separate faculty members who utilize CBL in their classrooms, one administrator

who is either the department head or the chair of the department's curriculum committee, and five to seven students who have recently had a class that utilized CBL. It was decided that these participants would be given a small monetary stipend for participating in order to increase participation. In the event of more participants volunteering than the numbers listed above, the contact person was instructed to randomly select individuals to participate. Eight of the initial nine programs contacted responded and agreed to participate and data collection site visits were scheduled during the month of February, 2010.

During each site visit, participants were required to sign an informed consent form prior to participating in any of the scheduled interviews. The informed consent form used can be found in Appendix E. At the beginning of each of the interviews, I reviewed the informed consent documents with the participants and answered any questions regarding their participation that they may have had. General demographic information was collected from each participant including age, gender, and title (student, faculty, administrator). The participant demographic form can be found in Appendix F. Specific demographic information was collected from each participant based on their participant role. For students, I asked them to identify what year they were within the program and what prior experience they have had with case-based learning before entering their present program. For program administrators and academic faculty, I asked them to report how long they have been in their present academic program, how many total years they have been teaching, what their highest earned academic degree is, what area of specialty do they teach in, and what prior experience they have had with case-based learning before entering their present program. This general and

specific demographic data was acquired to be used in the data analysis process to cross reference data sources and identify possible trends.

Data Collection

Data was collected from all eight participating schools through individual interviews with faculty and administrators, focus group interviews with students, and classroom observations. The primary researcher performed all of the data collection at the participating academic programs. The data collection at each individual program was conducted over the span of one day. There were only two programs that had actual case-based learning experiences scheduled on the same day as the site visit for classroom observations. Although I did utilize facilitator guides to assist me with the interview process, an emerging questions design was utilized during the data collection process. This allowed me as the researcher to allow the participant to direct the interview in the direction that they felt important in order to elicit rich and effective data. With this design of interviewing, I was also able to ask questions that emerged during the interview process and allow for further discussion that might have been outside of my realm of original questioning on the facilitator guide.

Individual interviews. Data was collected from the administrators and faculty through one-on-one interviews. During interviews with administrators, I focused on gaining a better understanding of the curricular plan of CBL in instruction in their respective programs. Some examples of questions that I asked were:

- What are your individual thoughts on the use of CBL in the physical therapy classroom?
- How has your program implemented CBL in the classroom?

- Is CBL part of the curricular plan or is it up to the discrepancy of the individual faculty to decide whether or not to utilize this tool?
- What indicators do you think exist that show CBL to be an adequate tool for delivery of physical therapy content?

Through faculty interviews, I was able to ascertain information about the actual implementation of CBL in the classroom. Sample questions that I asked faculty include:

- What are your individual thoughts on the use of CBL in the physical therapy classroom?
- In which ways have you used CBL in your classroom?
- What indicators do you think exist that show CBL to be an adequate tool for delivery of physical therapy content?
- In your opinion, what are the pros and cons of utilizing CBL in the classroom?

A copy of the moderator guide used in the one-on-one interviews with faculty and administrators can be found in Appendix G.

Focus group interviews. Finally, focus group interviews were held with current students in the programs being studied; and, from these, I was able to gain insight to the students' perceptions of the effectiveness of CBL in the classroom. Specific to the focus group interviewing process, I informed the participants of the idea of limited confidentiality due to the nature of the focus group setting. Some questions that I asked in these focus group interviews include:

- What are your thoughts on the use of CBL in the physical therapy classroom?
- From your experience, how has your school utilized CBL and was it effective?

- From your experience with CBL, what are the positives and negatives of this learning tool?
- Compare and contrast how you prepare and interact in a CBL experience as opposed to a traditional classroom lecture or discussion.

A copy of the moderator guide used in the focus group interviews with students can be found in Appendix H.

All of these interview sessions were recorded with a digital voice recorder and transcribed by the primary researcher. Data has been managed using the NVIVO8[®] software package by QSR International. All interview transcriptions and audio files were housed on password protected computers and the transcriptions were de-identified with a particular system in order to backtrack and identify the participant if needed after the fact.

Classroom observations. During the classroom observations, I was looking for a number of things including the interaction of students and facilitators, the participation level of all students, as well as the overall structure and execution of the learning experience. From these observation sessions, I gained a better understanding of how the teacher and program is utilizing CBL in the classroom. It also worked out that the student volunteers in the focus group interviews at these two programs were also in the classroom observation. This allowed me to ask questions about the learning experience with CBL. The classroom observations were not structured and thus I did not create a tool for performing these observations. Rather this methodology was only utilized to help me formulate questions in addition to the a priori questions found on the moderator guides as well as apply those a priori questions directly to a specific learning experience.

Data Analysis

All interviews recorded were transcribed and all data collected was analyzed by the primary researcher. Data analysis truly began during the data collection but more in depth data analysis was performed with a full analysis of the transcripts, observation notes, and methodological field notes of the researcher. Based on the evaluation model described in Figure 3.1, there were a set of a priori categories that existed prior to data analysis. These included the following:

- Definition of Case-based Teaching & Learning
- Extent of utilization and implementation of CBL in the academic program
- Intended purposes or expected outcomes of CBL in the curriculum/classroom
- Uses of Case-based Learning
 - Case formats
 - Case design and structure
 - CBL experience structure
 - Facilitation of the CBL experience
- Barriers to implementation of CBL in the curriculum / classroom
- Measures utilized in assessing outcomes of CBL in the curriculum / classroom
- Actual and perceived outcomes of the implementation and utilization of CBL

The data was then coded based on common ideas that presented in the transcripts. These codes were grouped into these a priori categories and were analyzed to identify any themes that emerged from the data. The relationships between these themes were identified and analyses of these relationships were used to help the primary researcher to draw conclusions

and make general statements regarding the implications of the findings. Data will be represented with numerous charts and diagrams for further analysis and demonstration later in this paper. This methodology follows that described by Miles and Huberman (1994).

Reliability and Validity

A number of measures were taken in order to assure reliability and validity of the data collection process including the implementation of a pilot study, the utilization of field journal for methodology and data analysis, member checks, and triangulation.

Pilot study. A pilot study was performed in the summer of 1998 which went through all of the steps described above. The LSUHSC IRB was consulted with regards to the need for approval for the pilot testing process. Based on the fact that the pilot study was part of a requirement for a course at the time, the project was deemed exempt from IRB review. An academic program was selected from the survey respondents that utilized CBL at a moderate to high level and that was fairly close in geographic proximity to the researcher. I drafted a letter similar to that found in Appendix D requesting participation and contacted the program director of the selected program via email. The program director agreed to participate in the pilot study and the site visit was successfully scheduled. I obtained informed consent from individuals for both the individual and focus group interviews. An expert program evaluation researcher and qualitative interviewer with over twenty years experience accompanied me during the site visit in order to provide me with valuable information and constructive feedback on my interviewing process. I created moderator guides for both the individual and focus group interviews similar to those found in Appendices G and H respectively. Upon implementation of the interview process, I used these moderator guides, but did not follow

them directly nor did I rely upon them a large amount. The expert evaluation researcher was able to provide me with valuable feedback on my moderator guides as well as my interview process as a whole.

Field journal. Throughout the research project I recorded in a methodological field journal. Keeping this journal allowed me to track my own thought process throughout the process of data collection and data analysis. By maintaining a methodological field journal, I was able to increase the overall reliability and validity of my findings by having a total record of the data analysis process. The field journal also allowed me to keep track of any researcher subjectivity and bias that may have negatively impacted reliability and validity of the research.

Member checks. During the interview process, I incorporated numerous strategies for ensuring accuracy of content. I used active listening strategies such as repeating, rewording, and paraphrasing the participants' responses so that I may assure that I was accurately and concisely understanding and recording their thoughts, beliefs, and ideas. I continuously kept field notes during the interview process so that I would be able to return to any particular area of the interview where I felt better or deeper clarification was needed. After the data collection was complete, I provided a general synopsis of the individual interviews and asked the participant to comment or clarify any points that I may have been inaccurate in my comprehension.

Triangulation. The purpose of this study was to examine the implementation, utilization, and perceived effectiveness of CBL in physical therapy curricula. To do this in the most comprehensive form possible, I used a number of different sources in my data collection including performing participant observations and focus group interviewing of students as well

as by interviewing both program faculty members and program administrators. Thus, I was able to get a full scale understanding of the intention and expected outcomes of implementing CBL in the eyes of the administrator, as well as compare this to how it was actually being implemented and utilized by the faculty as well as how it was being applied by the student learner.

Assumptions

Multiple assumptions are being made by the researcher in the design of this study, many which are inherent with qualitative research to begin with. The positivist research paradigm is one that bases its foundation in the idea of control. With qualitative research, a post-positivist paradigm is most often espoused where less control is accepted in lieu of being able to observe phenomena occur within the context of the environment that it is normally situated in. With this diminishment of control there is increasing room for error and assumption. One major assumption that I am making is that all of the schools that I will be looking at are utilizing CBL at a fair, moderate, or high level based on the findings of the survey discussed earlier. In other words, I am assuming that the participants who responded to the survey were honest and accurate with their responses. Since the selection of academic programs for participation was based on the results from the survey, I am also assuming that all of the inclusion criteria for selection were accurate as well. There is also the assumption that there was no bias in the selection of participants by the contact person at each respective academic program. There may have been the tendency to purposefully pick out students or faculty members who they feel have similar beliefs and feelings about case-based learning as they do. Thus, I am also assuming that neither the contact person nor any other participants

from each academic program have any hidden agendas affecting their participation and honesty in participating.

There are a number of assumptions that are made with the data collection as well. First, and foremost, I am assuming that all of the participants in the individual and focus group interviews were truthful and accurate in all of their responses. In the focus group interviews, I am thus assuming that peer pressure or interaction did not negatively affect anyone's willingness to disclose honest remarks, participate at all, or even move someone to report false or inaccurate data. In the design of the evaluation, I am making the assumption that my line of questioning during the interviews of the particular academic programs was performed in such a way as to provide me with an accurate and comprehensive understanding of the implementation, utilization, and perceived effectiveness in each of the academic programs. Finally, with the selection of the eight programs, I am making an assumption that there will be some level of generalizability of the findings to the population of academic programs in the United States. This is a fairly sizable assumption since there was minimal to no randomization in the selection of programs. The concept of generalizability that is seen in quantitative research bears a different meaning than that seen with qualitative inquiry. The assumption that I am truly making is that the information gleaned from how these selected academic programs are using and implementing CBL and how it is or is not leading to the outcomes they intend from its use will have some benefit for other similar academic programs experiencing some of the same issues with CBL or other teaching methods.

Summary

In this section, I have presented a thorough description of the qualitative evaluation research design that I have chosen to follow which is a variation on Hammond's Goal-Attainment model for program evaluation. I further described the participant selection methods that I utilized to make initial contact and gain entry into the eight academic programs studied. I also described the multiple qualitative data collection instruments that I have performed as part of the study including one-on-one interviews with faculty and administrators, focus group interviews with student physical therapists, and classroom observations of CBL experiences within these programs studied. A description of the data analysis process was introduced as well as a list of assumptions that the researcher is making throughout the process of the project.

Chapter 4: Results

Introduction

This chapter presents the findings of the data collection performed at the eight separate physical therapy programs across the country. Individual and focus group interviews were performed with administrators, faculty members, and students from each of these eight programs in order to answer the following research questions:

- To what extent are the selected physical therapy programs studied utilizing CBL in their curriculum and what different ways are they formatting, structuring, and applying CBL in the classroom?
- What are the factors that impact the effectiveness of implementation of CBL and what indicators exist that denote effective implementation of CBL in the selected physical therapy curricula?
- What is the perceived effectiveness of CBL in delivering physical therapy curricula by physical therapy students, faculty, and administrators of the selected physical therapy programs?

First, I present information regarding the demographics of both the academic programs themselves and the individual participants in the study. The next two sections of the chapter present the findings from the data analysis process in reducing the data collected from these participant interviews and observations. Codes and categories are described and defined first, followed by a description of the emerging themes and relationships. Overall implications that arise from these relationships will be presented in the following chapter.

Participant Demographics

As stated previously, there were a total of eight programs that agreed to participate in the present study. At each program, I performed interviews with an administrator, one or two faculty members, and a focus group of five to seven students. In total, 68 individuals were represented in the study across the eight academic programs. At two of the academic programs I was able to perform classroom observations during which I took extensive field notes and gained a better, more concrete visualization of the descriptions that came from the interviews. A full description of the academic programs and individual participants are presented in the following sections.

Program Demographics

Nine individuals were contacted requesting program participation in the present qualitative study investigating the utilization, implementation, and perceived effectiveness of case-based learning in the physical therapy curricula of these selected programs. Of these nine individuals, eight replied to my request agreeing to participate in the present study. These individuals then assisted in scheduling the site visits at their respective physical therapy departments and solicited participation from students, faculty members, and administrators. All eight of the individuals were themselves either faculty or administrator participants in the study as well. They utilized purposeful convenience sampling in selecting the participants and were instrumental in scheduling the interview times and classroom observations where available.

Pertinent demographic information was collected regarding each of the eight academic programs and is presented in Table 4.1 below. Appendix C shows the geographic location of

each of the eight programs represented in the study. Three of the physical therapy programs are located in the state of Florida, one was in Indiana, two were in Illinois, and two were in California. As can be seen in Table 4.1 below, three of the eight participating programs were

Table 4.1 Program Demographic Information

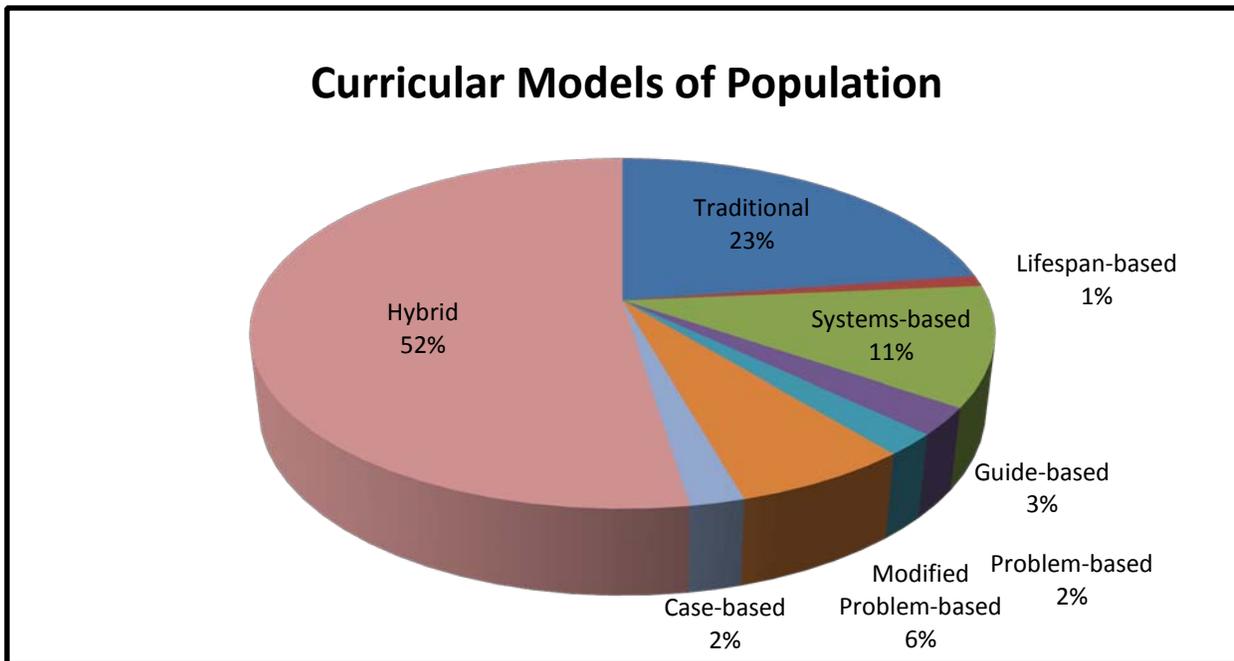
Participating Program Demographics								
Academic Program	P1	P2	P3	P4	P5	P6	P7	P8
Institution Type	Private	Public	Public	Private	Private	Private	Public	Private
CAPTE Curricular Model	Hybrid	Modified PBL	Hybrid	Hybrid	Hybrid	Systems-based	Hybrid	Hybrid
Accepting Class Size	24	24	36	50	48	90	36	44
Number of FTE Core Faculty	11	7	9.5	20	11	20	20	9.5
Overall Faculty: Student Ratio	1:6	1:10	1:11	1:7.5	1:13	1:13.5	1:5.5	1:10

public institutions with five being private institutions. As part of the demographics collected in the survey described before, the respondents denoted the type of curricular model their program utilized as reported annually in the school’s Self-Study Report (SSR) for the Commission on Accreditation in Physical Therapy Education (CAPTE). CAPTE’s definitions of these different curricular models can be found in Table 4.2 below (APTA, 2008). The majority of the programs participating in this study utilized a hybrid curricular model with one program using modified problem-based learning and another program utilizing systems-based curriculum as their curricular model. Figure 4.1 shows the percentages of the different

Table 4.2. CAPTE Definitions of Curricular Models for Physical Therapy Programs

Curricular Model	Definition of Model Designation
Traditional	The curriculum begins with basic science, followed by clinical science and then by physical therapy science.
Systems-based	The curriculum is built around physiological systems (musculoskeletal, neuromuscular, cardiopulmonary, etc.).
Modified Problem-based	The curriculum uses the problem-based model in the later stages, but the early courses are presented in the traditional format of lecture and laboratory.
Guide-based	The curriculum is built around the disability model, the patient management model, and the preferred practice patterns included in the <i>Guide to Physical Therapist Practice</i> .
Case-based	The curriculum utilizes patient cases as unifying themes throughout the curriculum.
Problem-based	The curriculum is built around patient problems that are the focus for student-centered learning through the tutorial process and independent activities.
Lifespan-based	The curriculum is built around the physical therapy needs of individuals throughout the lifespan.
Hybrid	The curriculum is designed as a combination of two or more of the previous models.

Figure 4.1. Curricular Models of the Population of Physical Therapy Programs



curricular models reported by the whole population of physical therapy programs in October 2007 (APTA, May 2008). Although 75% of the participating schools reported hybrid curricular models compared to 52% that are presented in the total population, I was fortunate to have two of the other curricular models represented in my small sample.

Demographics regarding student to teacher ratio within each of the programs was also gathered and can be seen in Table 4.1 as well. With regards to the number of students matriculated into the programs on a yearly basis, the average accepting class size for the program studied ranged from 24 to 90 with an average class size of the sample of 44. Table 4.1 also shows the number of full-time equivalent core faculty members on faculty at each of the programs at the time of data collection. This ranged from seven core faculty to 20 with an average of 13.5 core faculty per program. From these numbers, and the fact that all of the programs were three years in length, the overall faculty to student ratio could be calculated. These ratios ranged from 1:6 to 1:13.5 with an average student to teacher ratio of 1:9.5 in the schools studied. All of the programs studied were three-year entry level DPT programs.

Individual Participant Demographics

As stated previously, there were a total of 68 individuals who participated in the study. Prior to each interview, these participants signed an informed consent form and filled out a participant demographics form. Once again, the informed consent form can be found in Appendix E., and the participant demographics form can be found in Appendix F. The top portion of the participant demographics form requested the participant's name, Social Security number, and mailing address. This information was only collected in order to provide the participant with the stipend for participating and was not kept on record in any form once the

participant stipends were mailed to them. The rest of the participant demographics collected on the form were tabulated and descriptive statistics were used in order to provide a full description of the sample studied. Of the 68 individuals who participated, nine were program administrators (either program chair or the chair of the program's curriculum committee), 11 were core faculty members, and 48 were students of varying levels within their programs. Because physical therapy schools are all prescriptive cohort programs, all the students within a single focus group were members of the same cohort of students, and thus were all enrolled in the same courses together. Table 4.3 provides a full breakdown of the individual participant demographics of those participating in the study.

Table 4.3. Individual Participant Demographics

Individual Participant Demographics				
	Participants:	Administrators (n=9)	Faculty (n=11)	Students (n=48)
Average Age		54.44	45.82	25.85
Age Range		42-61	34-53	22-48
Gender				
Males		22%	18%	31%
Females		78%	82%	69%
Level of Prior Experience				
Large Amount of Experience		33%	27%	10%
Minimum Experience		56%	27%	54%
No Experience		11%	46%	36%
Student Level in Program				
DPT I		N/A	N/A	15%
DPT II		N/A	N/A	70%
DPT III		N/A	N/A	15%
Administrative Role				
Program Chair		78%	N/A	N/A
Curricular Chair		22%	N/A	N/A
Faculty & Administrator Experience				
Average Total # of Years Teaching		22.33	15.82	N/A
Average # of Years in Present Department		12.33	10.09	N/A

Administrators. One group of individuals that I interviewed at each of the participating programs was administrators of the physical therapy department within the program. Table 4.3 presents some of the demographic information for these administrators involved in the study. In requesting participation of administrators, I specified that I was interested in the individual who is in charge of the curricular decisions of the department. Of the programs studied, six of these individuals were department chairs. At one of the academic programs I was able to interview the program chair and the chair of the curriculum committee. In another program, the individual studied was the chair of their curriculum committee. The majority of these individuals were female with an average age of 54 and an average of 22 years teaching. The total number of years that the individuals had been associated with their respective programs ranged from 2 to 25 years. All of these individuals held doctorate degrees with the majority having a PhD as their highest degree earned. Other than administration, these individuals have varying areas of specialty representing multiple disciplines within the profession of physical therapy including orthopedics, pediatrics, neuromuscular, acute care, and ethics. A large majority of these individuals had had anywhere from minimum to a large amount of experience with case-based learning prior to coming to the present program with only 11% reporting no prior experience at all.

Faculty members. The next group of individuals interviewed in each of the participating sites was faculty members. When recruiting participants I instructed my contact person to select either one or two faculty members within the program that used case-based learning in their courses to some degree. The contact person at half of the programs involved scheduled interviews with two faculty members and the remaining schools with just one. Some of the

basic demographics for these individuals can be found in Table 4.3 above. Similar to that of the administrators, the average faculty member interviewed was female with an average age of 46 years. On average, these individuals had been teaching for 16 years and had been at their respective positions for 10 years. Unlike the administrators, almost half of these individuals reported never having any experience with case-based learning prior to the teaching position that they currently held. This group of individuals represented the same level of diversity of area of specialty as the administrators discussed previously with the addition of specialties including geriatrics, wound care, oncology, and business administration. Of the 11 faculty members interviewed, only seven held doctorate degrees with the remaining 27% holding master's degrees as their highest degree earned.

Students. In total there were 48 students who participated in the study. The focus groups ranged in size from 5 to 7 students each (three programs with five, two programs with six, and three programs with seven). Table 4.3 provides the averages of all of the general demographics collected from each of the student participants. As with the other two groups of individuals participating in the study, the majority of students were female. Most of the students participating (70%) were in their second year of their respective DPT programs with one school having a focus group of first-year students and another program having a focus group of third year students. The average age of the student participant was 26 years with the majority (56%) falling within the age range of 22 to 24 years. There were 15 students (31%) between the ages of 25 and 29, and six students (13%) who range from 30 to 48 years of age.

It can be seen from all of the participant descriptions above that a wide variety of academic programs as well as individual participants were involved in the present study. This

diverse creation of participants was very important and beneficial in order to get a broad representation of ideas and thoughts from a diverse group of individuals regarding the utilization and implementation as well as the perceived effectiveness of case-based learning in physical therapy curricula.

Codes and Categories

In order to answer the research questions posed at the beginning of the chapter, a total of 28 individual and focus group interviews were conducted in February of 2010. Each interview was approximately one hour in length and all of the interviews were conducted by me, the principal researcher. I utilized facilitator guides for each of the interviews to assist in prompting me to ask a series of questions that would guide me toward the answers to the research questions studied. I did utilize an emerging questions design of interviewing though, where the interviewer allows the person being interviewed to have some control and direction of how and where the interview proceeds. This openness gives the interviewee the opportunity to discuss things that I as the researcher may not have thought about at the outset but that may be vitally important to the evaluation of case-based learning in the interviewee's academic program. Because of this openness and minimized control of the interview process, there may have been some aspects that were discussed in one interview but not in another.

All of the interviews were recorded using a digital voice recorder and all of the data collected (document, audio, field notes, etc.) were stored electronically using QSR's NVIVO 8[®] qualitative data software package. All of the audio files were transcribed by me, the primary researcher, in order to initiate the data analysis process. Once the interviews were all transcribed, the interview transcripts were then coded with the assistance of the QSR's

NVIVO 8® qualitative data software package. The codes were grouped under a series of a priori categories that were determined as part of the Hammond’s Goal Attainment Model for program evaluation described in chapter three. A complete list of the codes and categories can be found in Appendix I. This table displays the three main research questions of the study with categories and sub-categories of data that go to answer each respective research question. Under each of the categories and sub-categories is a description of the codes that are situated within those categories. The table also displays the representation of the codes in each of the 28 interviews that the codes were discussed in. As can be seen, over 200 codes were identified in the data with representation ranging from one interview to 22 interviews. The following sections will discuss and define the main categories used to answer the research questions as well as describe the different codes that make up each of the 11 main categories discussed.

Definition of CBL

As stated previously in this paper, there exists much variation between what individuals call case-based learning and how they are using case-based learning. Thus, the first two questions asked in each interview were as follows:

- To begin with, I just wanted to clarify by what I mean by the term “case-based teaching or learning”. But first I want to hear what you think I mean by that. What do you think about when I say case-based teaching and learning?
- What do you think constitutes a case?

These questions were not necessarily used to answer any of the research questions that I was interested in, but moreover, were aimed at gaining a better understanding of how the

individual participants defined case-based learning to assure that the findings from all the interviews were consistent.

Definition of case-based teaching and learning. In almost all of the interviews, the participants were able to give very accurate definitions and descriptions of case-based learning as is consistent with the definition and description presented in Chapter 1 of this paper. The following quote provides an example of one of the participant's definitions of case-based learning and is used to illustrate the point that there seems to be a clear understanding of the definition among the participants in the study.

Case-based teaching is teaching that uses a case as the primary instructional tool whether it is to totally drive all of the student learning and organize all of it or simply as the primary method of illustrating the delivery of material.

Even the student participants within the study were able to provide clear definitions of what they would consider case-based teaching and learning. In many instances, the individuals would merely describe how their academic programs were using cases in order to define case-based teaching and learning and may not have provided as clear a definition as quoted earlier. Even though some variation existed across the definitions, minimal clarification was needed from the researcher to describe what was meant in the interview questions following.

Definition of a case. As with the definition of case-based teaching and learning, there was universal agreement amongst participants as to the definition of a case used for teaching with CBL methods. There were many participants like before who defined a case based on the description of cases that may be used in their own teaching and learning experiences. Few individuals presented a very broad definition of a case by describing how it could be any entity

and not necessarily an individual person. For example, one may think of a private practice corporation in physical therapy as a case to be used in an administration class. The majority of the definitions given in the interviews, however, simply described a case as a physical therapy patient somewhere within the continuum of care that is used to pose a problem or present an illustration to the learner.

Case-based learning versus problem-based learning. There were a number of participants who defined case-based learning by first defining that it was not problem-based learning. It was evident in talking with a number of individuals that problem-based learning has the tendency to evoke strong emotional feelings either for or against its use. One of the interesting findings from the many discussions in the interviews regarding the difference between problem-based learning and case-based learning was the difference between the ideas of an instructional tool versus that of a curricular design. It was common that when someone would describe case-based learning that they would describe it as an instructional methodology; whereas, when discussing problem-based learning they often described it as a curricular design. The following quote provides an illustration of this definition of problem-based learning as a curricular model:

Problem-based from my understanding of it ... is patient cases where the whole curriculum is based on cases and they don't really have courses in anatomy and physiology, or exercise physiology, or pharmacology, or neuro, etc. They use the case to pull those things out and where people then have to work in small groups and go and do the research to understand the case. So it's a paradigm shift for teaching as well as learning.

While this definition may give a good description of a problem-based curriculum design, it excludes the possibility that a problem-based learning experience may exist in any form of curriculum or classroom in isolation as an instructional methodology only. One of the academic programs studied, as noted previously in Table 4.1, utilizes a modified problem-based curricular model. The administrator, faculty members, and students interviewed from this program seem to understand fairly well the difference between problem-based learning as an instructional methodology and as a curricular model. One of those interviewed even discussed the taxonomy presented by Harold Barrows (1986) that was presented earlier in this paper as providing the main operational definition for case-based learning in this paper as one of the many problem-based learning methods on the continuum.

As a whole it was found that all of the participants had a fairly clear understanding of the terms case-based teaching and learning and how they were being used in the questioning of the interviews. Even though I am presenting this as a category in my data analysis, it is not directly contributing to the answers of any of the research questions posed before. Therefore, it will not be considered any further in this paper; and furthermore, it will be assumed that when discussing individuals' perceptions and thoughts regarding case-based learning that there is a consistent definition across-the-board. The following sections describe categories and their respective codes that were identified in order to answer the research questions using a modified Hammond's Goal Attainment Model described before in Figure 3.1.

Extent of Utilization and Implementation of CBL in the Academic Program

The second step of Hammond's Goal-Attainment Model, as described in the previous chapter, is to identify the institutional and instructional variables involved. In order to get a

better idea of all of these variables, I asked about how the different programs were using and implementing case-based learning in their curriculum. As was expected, all of the eight programs were using case-based learning in some form or fashion within their courses. Through analysis of all of the interview transcriptions, 11 codes in three separate subcategories were identified. These subcategories included the level of implementation in the curriculum, the methods of implementation in the curriculum, and utilization within the curriculum/course. The following sections provide a description of these codes in categories.

Level of implementation in the curriculum. In order to gain a better idea of the extent to which the academic programs were implementing case-based learning, participants were asked to describe how case-based learning experiences were purposely introduced into the curriculum. From the information gleaned, there was a wide variety of the level of implementation of CBL throughout the curricula of the eight programs. The lowest and most universal level of implementation was at the individual course level. Many of the administrators reported the importance of faculty autonomy in choosing their preferred method of instruction within their classroom. It was also discussed in numerous interviews that teaching with cases in physical therapy courses was almost inherent given the fact that it is an entry-level professional education.

The next higher level of commitment to and implementation of case-based learning is to have it be a major part of one's curricular design. This would include academic programs that had made the conscious choice at the administrative level to build certain case-based learning experiences into the curriculum plan. Three of the academic programs studied reported having case-based learning as a major aspect if not the major design of the curriculum. One of these

programs has a modified problem-based learning curricular model, while another utilizes a systems-based curricular model. The following quote provides an example of how certain cases were built into the curricular design of one of the programs studied.

The cases all stand for something. Well, I discovered after the fact though that we had somebody who was leading one of the cases and would just drop the case. You can't drop the case, the cases stand for certain material.

This quote illustrates how specific cases had been chosen and placed into the curriculum for specific purposes and to teach specific content.

Another major administrative decision regarding the implementation of case-based learning is the decision to require that faculty utilize specific cases or case-based learning in general. Half of the programs studied reported some level of faculty requirement for using case-based learning in the classroom. The previous quote as well as the following quote demonstrates some level of faculty requirement for utilizing case-based learning in the classroom.

As I've gone on trying to educate faculty about it what I said was, "if you don't want to use the case as driving all of the learning, the case doesn't have to drive the learning – you have got your objectives -- you could also use the case as just an illustration. You can do your primary teaching and use the modalities you want. The only real requirement is that you use or refer to the case to some extent in your teaching.

Of course none of the academic programs studied required case-based learning as the only method for instruction.

The final level of implementation of case-based learning within an academic program is using cases to teach content across different professions. Of the eight programs studied, two of these programs reported using case-based learning in interprofessional education experiences. One of these programs described a case-based learning experience where physical therapy students were working alongside students from a local physical therapist assistant program. Through this experience, the students were not only attaining didactic knowledge through the process of working through a case, but they were also learning to interact with each other as professionals. At another academic institution, students from all of the health sciences professional schools were working together on one case in a series of small group collaborative learning experiences. The eight different professions involved ranged from nursing to pharmacy and from physical therapy to osteopathic medicine. I had the opportunity to observe one of these inter-professional case-based learning experiences, and I was able to see how the students from different professions were able to represent and teach concepts from their own professional knowledge base as well as learn about other professions from the other students involved.

Methods of implementation in the curriculum. Another aspect of implementation of case-based learning in physical therapy curriculum that emerged from the data involved different methods of structuring this implementation within the curriculum. The three codes in this subcategory included implementation in the latter portion of the curriculum, implementation between courses within a semester, and implementation between courses across semesters. Most physical therapy curricula begin with a series of basic science courses such as human anatomy and physiology, neuroanatomy, pathophysiology, and biomechanics.

Multiple people interviewed discussed how case-based learning was a good instructional methodology for more clinically oriented courses but that it was not traditionally utilized in the majority of these basic science courses. The next quote from one of the student focus groups gives an example of this implementation of case-based learning later in the curriculum after the bulk of these basic sciences courses have already been taught.

The whole first year was pretty much the standard class instruction. We had the typical class where they just do lectures and stuff like that in the beginning, but then we moved into the case-based classes where we had a hypothetical case and had to use that past information and bring in new stuff that we could find from whatever resources we wanted to.

A majority of the programs represented in the study reported implementing case-based learning in this fashion.

The other methods of implementing case-based learning in physical therapy curricula dealt with what some of the participants called horizontal and vertical integration of curricular content. These terms are better defined in the words of the participant as follows:

So we decided as a group to come up with a more organized and efficient case-based format in order to deliver content and start to think about how to integrate learning across the curriculum. Our curriculum is designed in an integrative approach in that each semester builds on the previous so it has a vertical integration. Then within the semester, we also horizontally integrate the content so if you're getting content in one class it is similar or connected to content in another course.

Twelve of the participants described how their programs were using cases in order to integrate content from multiple courses within a semester. Many of these individuals discussed how it was almost impossible not to integrate content with the application of a case as an instructional methodology. They described how patients presented with multiple different psychosocial issues, diagnoses, and co-morbidities which inherently require the learner to pull from multiple different areas of physical therapy content. Participants from half of the programs represented discussed how individual cases are purposefully used to span multiple semesters of coursework. They described how the learner is able to apply concepts of differing levels to the same case over time and gain a better understanding of how these differing concepts impact the patient as well as gain insight into how a patient may progress over time.

Utilization within the curriculum/courses. The final subcategory describing the extent of utilization and implementation of case-based learning in physical therapy programs describes how cases are being used as educational experiences in the classroom. The four codes that comprise this subcategory are utilization of cases as an adjunct to lecture, as the primary method of instruction, as a lab activity, and as a module at the end of the semester or course to provide an overall review of the content learned. An overwhelming majority (19) of the participants interviewed described classes were overall course structures where case-based learning was the primary method of instruction utilized. Most of the case-based learning courses described in the interview transcriptions occurred in either the second or third year of the curriculum and are designed to assist the learner in "pulling it all together". Another large group of participants described how cases were used in collaboration with a traditional lecture format in order to reinforce the content learned. This is described in the quote below.

Most of the courses are using case-based learning from a supportive standpoint.

The content is delivered through a more traditional format and then cases are used really to support that learning process and give it a more realistic learning application.

A smaller number of participants further described the supportive use of case-based learning instruction in the context of lab-based instruction. These participants described how cases carried over into the lab in order to allow the student to apply actual psychomotor skills to the scenario of the case.

Intended Purposes and Expected Outcomes of CBL in the Curriculum/Classroom

The next step in the goal attainment model described before is to identify the intended objectives and outcomes of the instructional methodology study. Throughout the course of the interviews the participants were asked why they or their respective programs use case-based learning in delivering physical therapy content. In creating the a priori categories for data analysis, two different aspects were examined including the overall purpose of using case-based learning as well as those outcomes that were expected from its use. When analyzing the data for the purpose of reducing the data, many of the codes between these two were either synonymous or redundant. Therefore, the description of the following subcategories entails a combination of both the intended purposes and roles of case-based learning in the curriculum and classroom and the expected outcomes of implementing case-based learning in the academic programs. Over 30 different codes comprising five subcategories were identified in this category including assessment of student learning, enhancing clinical reasoning, enhancing

learning, applying knowledge in the context of physical therapy practice, and fostering lifelong learning.

Assessment of student learning and performance. The utilization of case-based learning in a practical examination format is widely used throughout physical therapy programs as a way to assess a student's ability to perform the roles and tasks of a physical therapist in a controlled environment. In practical examinations the student is required to pull from cognitive and affective knowledge and perform specific psychomotor tasks unique to the practice of physical therapy. Two main formats are commonly used in order to perform these examinations including a skills check-off with oral exam format and a simulated patient/practitioner interaction. This simulated experience is often built around a case where the student interacts with someone representing a patient and is graded for their ability to interact and perform the duties required of the interaction. Of the programs studied, 75% reported utilizing case-based learning in their academic programs in this fashion. Many of the different variables and ways of designing these case formats will be discussed later in this chapter. This concept is introduced here primarily because it was referred to quite often in the interview transcripts the administrators as one of the main reasons for using case-based learning and academic programs. Therefore this subcategory falls more under the realm of purpose of utilization rather than intended outcomes of implementation. The following subcategories all speak to both purpose and intended outcomes.

Enhancement of the learning of content. The most common purpose for utilizing case-based learning in the classroom of physical therapy programs discussed in the interviews was its use to enhance the overall learning experience of the student. This was evident in some way,

form, or fashion in every interview and class observation performed during data collection. There were eight major codes identified describing the different aspects of learning that is impacted by the implementation of case-based learning experiences. These can be broken down into primary learning aspects dealing with the initial processing and learning of material and secondary learning aspects that deal with managing knowledge and content once it has been attained by the learner.

As a whole, the participants discussed multiple primary aspects of learning that were enhanced or impacted through case-based learning. Some of the most common aspects discussed included its ability to actively engage the learner in the process, to assist the students in making connections to prior knowledge, and to make the learning process meaningful to the student. One faculty member put it this way:

Well, I think that case-based learning makes a lot of sense from the learning aspect of things if we know what learning really entails. ... We know that that learning occurs best when we make connections with prior learning and then when we're actively engaged in that process those almost go hand-in-hand so from that aspect it's great ...so the benefits there are – it's active, it's engaging, but I think it has to be connected to something that they can connect with as well.

Another faculty member went on to say:

I think it helps them learn it and remember it better because they can actually take what the signs and symptoms are and instead of having a list to memorize, they have a case that they can kind of picture in their head and really make that

list meaningful. Then it helps them recognize signs and symptoms and recognize when a particular treatment is necessary and makes it much easier for them when you can both give them the information and then make them use that information immediately in a real-life situation. For me, it's a way of enhancing learning and it makes it a whole lot more interesting for the students - you can almost see them sighing when you finish talking about this list of signs and symptoms and you have them work through a case and apply it to a case and include them in the lecture.

Another primary aspect of learning that was discussed by multiple participants was the idea of providing multiple ways of learning for students with differing learning styles. The following faculty member expounded on this by stating:

What I will say is different is addressing those different learning styles and those different functions of learning that we all have. You know, we have that hands-on where we try it ourselves so that we know what it feels like but then we also need some time to sit down with the book and read and digest. I think that case-based is a part of that- 'How do I organize my thoughts when I'm presented with information, some of which is not important some of which is important?' So, I don't know that case-based is better than any of the other methods we use, but I think it's one way for people to assess themselves at 'How am I doing with this?', 'How do I organize my thoughts?' So it's another one of those learning tools ...but I think that case-based holds its place in the sense that it gives those

people who do learn better with cases that opportunity to really pull things together for themselves... again we want to give our learners multiple ways.

All of these primary aspects of learning were provided by participants when asked about the purpose behind utilizing case-based learning in the classroom to enhance teaching and learning. The intended outcomes that correspond to these stated purposes would be that the student is actively engaged in the learning process, that the student does create connections between basic and clinical knowledge, and that the student utilizes multiple different forms of learning in developing their professional knowledge base.

The secondary aspects of learning dealt more with how the learner uses the knowledge they've attained after the learning experiences occurred. Some of these aspects would include the cognitive reinforcement of previous knowledge, the integration of this knowledge into multiple aspects of physical therapy practice, and the transfer of this knowledge into the clinical setting and actual patient interaction. Some of these secondary aspects were addressed in the quotes listed above. The following quote from an administrator discusses the role that case-based learning can play in helping the student integrate physical therapy knowledge.

If I were to think about the term integration, with the case you can integrate content from anatomy, biomechanics, clinical skills, transfers, cardiopulmonary, neuro, musculoskeletal, ... I mean in one patient you can do that by creating and I mean we don't have to make these things up - they exist. So you can get the students to think more holistically and not so linearly. In other words they have to think of all the other things that are going on at the same time.

In discussing case-based learning with administrators, faculty members, and students a common idea discussed was the fact that the use of case-based learning could almost be considered inherent in physical therapy professional education. Many of the participants stated that it would be almost impossible to teach a student to evaluate and treat a physical therapy patient without teaching them in that manner. A large number of participants reported their belief that case-based learning provides the best medium to get at these primary and secondary aspects of learning in physical therapy education.

Enhancement of the clinical reasoning of the learner. One of the main aspects commonly discussed in the interviews of the participants was the unique ability of case-based learning to enhance the overall clinical reasoning of the student. In the interviews, the participants described how the expansion of the field of physical therapy from a profession of individuals who carry out tasks prescribed by a physician to a profession of individuals responsible for the decision making process of evaluating and treating patients has increased the complexity of physical therapy education. Within the realm of clinical reasoning, the participants discussed many aspects that are impacted by case-based learning. These include critical thinking, clinical problem solving, clinical decision-making, and the efficiency and precision of all of these. When discussing the aspects of learning previously, the outcome was more the product of learning physical therapy content. In discussing the aspects involving clinical reasoning, the participants were more interested in the process of applying these products of learning to the clinical setting.

When asked about what a student needs in order to be successful in a case-based learning experience one student replied:

I think *critical thinking* because some people can memorize forever but they can't really apply stuff or think about it and come to conclusions on their own. I think some people are more prone to thinking that way - you know grown up being challenged more that way - Some people are more prone to it but you can learn it - you can get better at it. It isn't something that you can teach directly but by challenging it you can get better at it I think.

This student went further to discuss how case-based learning can be used to enhance the process of critical thinking in the learners. Another participant discussed the process by which students hone in their problem solving skills through repetitious practice and facilitator feedback.

I think that they practice thinking about what they would do because of a certain presentation of the patient. They get feedback as to whether their thinking was in line or was their thinking divergent from what it should have been. And then we move on, we may try something else, move on to a different type of intervention strategy or different type of patient.

The following quote describes how this learning is aimed at more than mere memorization of facts:

I've always viewed cases as a way of taking the information to a higher level of application and depending on the amount of exposure that a student had in a particular topic area before, I think they may get to the level of synthesis of information and true integration and being able to take that knowledge and take it with them and it's part of their repertoire for what they understand.

The faculty and administrator participants reported that the main objectives of using CBL in their instruction was to foster individuals who were proficient at solving problems and thinking critically about a physical therapy patient's individual circumstances.

Application of knowledge within the context of physical therapy practice. Another major purpose in utilizing case-based learning in physical therapy education is that it gives the learner the ability to apply knowledge within the context of actual physical therapy practice. As Herried (1994) put it, "it's a rehearsal for life". One student put it fairly simply as well by stating, "It makes it more realistic to what our job is going to be." This quality of CBL can be directly tied back to the primary aspect of learning discussed before – the ability to make it meaningful to the learner. Other topics regarding the contextual nature of CBL raised by the participants included that it allowed students to practice the skills of the profession in ways that would easily transfer to the clinic and it provided a learning experience that really gave the learners the ability to build a connection with the patient case. The following quote describes this facet of CBL experiences.

I think that the cases help put into perspective that the student and the therapist is going to be working with a *person* and that *person* is going to present uniquely no matter what. And so you're really preparing the student in case-based learning to go out and work with a *person* to achieve goals towards activity and participation.

The major outcome that would be expected of the learner from the contextual use of CBL would be that students have an enhanced ability to connect with and truly understand the

patient in their interactions, demonstrate empathy for the patient, and be better prepared for entering their clinical rotations and clinical practice as a whole.

Fostering of lifelong learning. As fast as the profession of physical therapy has been changing in the last few decades and with the increased emphasis being placed on evidence-based practice, it has become vitally important that physical therapy education fosters the understanding and skill of lifelong learning in its learners. The following quote was from an administrator in reply to the question of what would be expected out of the learner through application of case-based learning in their program.

Just clinicians who can think on their feet that are active learners and they know where to go and find the information. They know how to do the research, look at the research, and apply it. You know we don't just ask them to go to their textbooks and find out about this treatment intervention we have them exploring current evidence and especially as they go through the curriculum we expect more and more of that to be that they can tie it more into evidence-based practice.

This quote is very similar and representative of many of the participants' expected outcomes of the learner through application of case-based learning.

Methods of Using Case-Based Learning

In assessing the behaviors described in the intended objectives and outcomes, there are two main areas to focus on within the present study. The first of these would be to gather a full description of the different ways the academic programs studied are using case-based learning in their classrooms. The other topic of interest would be to identify the different barriers that

may exist amongst the academic programs that may negatively affect the implementation and utilization of case-based learning in these programs. This section will discuss the different aspects of how the programs are structuring and using case-based learning in their classrooms and the potential barriers will be discussed in the following section. When discussing the development and usage of CBL in the academic programs, four main categories emerged including which formats of CBL the programs are using, how they are designing and structuring the case, how they are designing and structuring the case-based learning experience, and how they are facilitating the case-based learning experience. All of these are discussed in the following sections.

Format of the case. There are many different ways that cases can be presented to the learner in a case-based learning experience. The most common of these include paper cases, video cases, role-playing, standardized patients, and live patient interactions. It was found that many different considerations have to be made in order to best discern which format would be best at meeting the intended learning objectives given the specific learning experience. It was also seen that in any given learning experience, there may be more than one format used. For example, an instructor may decide to present the case information on paper prior to having the learner interact in person with the actual patient. Here I will discuss many of the different points that the participants raise with regards to each of these.

The most common reported format of the case-based learning experiences discussed in the interviews was the paper case. This would be where the instructor presented the information to the learner regarding the patient to be studied either typed on a handout or electrical document. Compared to the other formats presented, this format is the easiest to

produce and most cost efficient of all of the formats. It is also the most commonly used format when combining multiple formats as described previously. Even though it is the most commonly used, many participants pointed out multiple limitations that this format presents. One of the most common limitations being that the learner has only that which is typed on the page to use in guiding their decision-making process. One student described that not being able to see the patient made it very difficult to draw conclusions and assumptions about the patient and their care. The student described how it required the learner to use their own imagination in order to fill in the holes of that which was unknown regarding the patient. The student group pointed out that often times this would be different than that which was imagined by the instructor and thus would lead to conflict. In contrast, one faculty member pointed out that, compared to all of the other formats, the paper case may be the most flexible. She made the point that you can't change the video once it's been taken but you can always ask the student "what if questions" about the paper case and change it instantaneously.

The next format discussed included the use of audiovisual materials in presenting the case. A number of programs talked about how they used paper cases with the addition of photographs in order to assist of the student in connecting and imagining the patient. Some of the participants also discussed presenting radiographic images, pictures of wounds, and other media that would provide the learner with more objective data that they may actually see in the clinical setting upon which to make their clinical decisions. The most common audiovisual format utilized, however, was the use of a video of a mock or actual patient. Participants from 75% of the programs studied described how they used video cases as either the primary format for delivery of the case or in combination with other formats. When describing the rationale

behind choosing this format, the participants most often referred to the fact that there are some skills of observation required of the learner that cannot be practiced or assessed through the use of a paper case. The most common of these observation skills discussed was that of gait assessment (the biomechanics of walking) and other functional mobility. Four of the participants were specialized in pediatrics and all four of these individuals described how they use videos in presenting cases where children were the patients. They all remarked on how important it is for students to be able to visualize the mobility aspects of children and how difficult it is to teach and present this content without that visual component. One of these also described how she is able to model clinical practice through the presentation of the video as well. She remarked, "They see real-life and they see how I respond to it." The only barriers discussed regarding the use of videos as cases dealt solely with the availability of patient videos. Most of those using videos as cases remedied this by videoing their patients and their own practice for use as instructional tools.

Role-playing is another common format used in the case-based learning experiences of the participants interviewed. Three main methods of role-play were described including student role-play, faculty role-play, and the use of standardized patients. All of the programs involved utilized role-play in one of these three manners, with the most common being student role-play. This is where student is given information about a case and prompts for responding to questions and actions of their classmates. The student then acts the role of the patient giving the other learners the opportunity to interact with a real person as the patient. With faculty role-play, the faculty member plays the role of the patient under the same circumstances. A standardized patient is an actor who's been specifically trained to play the

part of the patient during small group or individual encounters with students. Half of the programs studied utilized standardized patients either as learning experiences or in the assessment of their learners. The major benefit of using role-play described by the participants was that it gives the learner the opportunity to interact with the "patient" and develop the professional skills of communication and patient handling. Although the students enjoyed the experience as a whole, overall they prefer to have standardized patients or faculty role-play. They felt as though these individuals are more knowledgeable of how the patient should act and react within given circumstances. Some of the faculty preferred to have the students role-play because they felt that the learner who is role playing may be given the opportunity to experience empathy by placing themselves in the position of the patient. The major drawback of the use of standardized patients as described by administrators and faculty alike was the administrative costs incurred that prohibited this from being an efficient tool within the curriculum. They also discussed availability of actors as being prohibitive as well.

The last format, live patient interaction, was also used in every participating academic program. This format of case-based learning is very similar to formal clinical education which is required by CAPTE. In this formal clinical education, the learner goes into the clinic for an extended period of time and is supervised by a licensed physical therapist in the field. When using live-patient interaction as a case-based learning method, the experiences are often facilitated or evaluated by a member of the faculty. In most of the experiences described by the participants, these were done in small-group or whole class structures and have very specific learning objectives built into the experience. All of the student groups unanimously reported preferring this kind of interaction and described it as being one of the most impactful

learning experiences they have had. One student did address a common limitation of this format discussed by the faculty by stating:

It would be awesome if we could go to the hospital and see all of these types of patient's but that would be super ineffective for our time so yeah I would say that it's a really good way of focusing it into the class period that we have.

It can be seen that many factors must be considered when deciding which format would be the most beneficial, realistically available, and efficient in meeting the intended objectives of the case-based learning experience.

Design and structure of the case. Through data analysis of interview transcriptions, multiple issues regarding case design and structure were found. The 10 codes identified dealt mostly with the amount of information included, the complexity of the case itself, and from where the cases were derived. As described earlier in this paper, cases may be developed in a number of different ways and from a number of different sources. Prefabricated cases could be used that are found in textbooks, texts devoted to case studies, and case repositories including MedEd Portal (an online repository for peer-reviewed, enduring medical education materials). Cases could also be fabricated where the instructor starts from scratch and build the case based off their own imagination and knowledge of the content area. Cases may also be written or designed, either directly or indirectly, from an actual patient in clinical practice. This was the most common way of developing cases described by the faculty and administrators interviewed. One faculty member commented that if you have been in clinical practice, more than likely your fabricated cases are based on real-life patients anyway. She hypothesized that more than not the fabricated case is a combination of multiple patients that you have seen in

the past. The discussion regarding cases designed after a real patient came up in five of the eight student focus groups. Many of these students described how it was important for them that the cases be based off of real-life patients. A majority of the students remarked that they appreciated the ability to hear what actually happened with the physical therapy patient's encounter, either during or after they worked through the case. One student remarked that it made her feel like she was "really doing something useful and meaningful" when she was working through case that had been an actual patient.

The other main aspects of case design and structure were the amount of content included in the case and the amount of complexity built into the case. When discussing the amount of content, this takes into consideration the amount of information given about the patient. Some of the cases described only consist of one or two lines of text in a small vignette. The main purpose given for presenting the information in this fashion was to direct the student to a very specific piece of content or a specific psychomotor task to be performed in lab. This is in contrast to the description of the rationale for the size of cases in case-based learning described by Barrows (1986) in his taxonomy. He described small cases with limited information being the main medium for the more problem-based learning activities. Only participants from the modified problem-based program involved described a small case vignette for the purpose of leading to open inquiry of the learner. With larger cases, the participants reported having to differentiate between extraneous information and supportive information included in cases. Many of the participants described how including a large amount of supportive information (home life, occupation, family situation, etc.) helped to make the patient seem more realistic to the learner. They also described how too much extraneous

information that had nothing to do with the case can detract from the learning experience. The intricacies of this balance between too little and too much information will be discussed at the end of this chapter.

The last aspect of case design and structure described by the participants was the level of complexity of the case. A distinction was made through the process of data collection between the amount of content in a case and the level of complexity of a case. It was noted that just by adding more content to a case does not necessarily have anything to do with the complexity of the case. Many faculty members described the importance of understanding where the student was in the curriculum, what content they had already had, and what content they are concurrently receiving in order to understand the level of complexity needed within the case. Participants described that if you give too much information as to diminish the complexity of the case then you lose the teaching quality of the case. This was best worded by one of the participants as follows:

If the case has just a stream of data in and of itself then you are really getting a case that's already been analyzed to some degree. But if your case has those thick descriptions of what the patient looks like, what you're going to find out, what the family is like, so you don't give a case that's already been processed.

This raises another issue of balance that will be described further later in this chapter. One method of increasing complexity and content but still posing a problem to be thought through to the learner is the use of an unfolding case design. This design was discussed in 14 of the interviews in six different programs. In this design, the learner is given a little information up front and as they work through the case the facilitator continues to provide them with more

and more information so that by the end of the case-based learning experience, they have the whole case.

Structure of the CBL experience. There were two main aspects of structuring the case-based learning experience that emerged from the data: the grouping of the learner and the sequencing of the case-based learning experience. In designing a case-based learning experience, it can either be developed as an individual experience, a small-group learning experience, or an experience within the confines of the whole class. The most common form of grouping used was the small-group learning experience. This was discussed in 19 of the interviews and was also the grouping format utilized in both classroom observations performed. Even though a majority of the programs reported using whole-class grouping experiences, they described many drawbacks regarding this format. Many faculty members discussed the difficulty of facilitating a whole class through a case-based learning experience. They described how it made it much more passive for the average learner in that "you would always have those five or six who speak up and the rest would be quiet." The individual case-based learning structure was only brought up during 10 of the interviews and all dealt with evaluation of the learner in a practical situation as described before.

Other codes identified under the category of structure of the case-based learning experience were involved with the sequencing of the experience. The first issue of sequencing dealt with the use of cases in conjunction with lecture. For those teachers using cases as an adjunct to lecture, some of them provided the lecture first and then the case while the others performed the opposite. The benefit described of supplying the learner with the case first was that it helped the learner focus and think during the lecture. The rationale for introducing the

case after the lecture was that by doing so one would be able to reinforce the information learned in the lecture by applying it to the case directly afterwards. Many of the students in the focus groups described how they liked having the case shortly after having the lecture; however, they stated that sometimes when they have been in lecture for a long time, they don't have the energy required to apply the information appropriately to the case.

The other main aspect of sequencing the case-based learning experience dealt with the mixing of different grouping structures. Three individuals described how they would structure the case-based learning experience as an individual project first, followed by a small-group project, and finishing with a whole class discussion comparing and contrasting the different groups' responses. Another instructor described how she would structure her case-based learning experiences in the opposite fashion starting as a class discussion and ending with an individual homework assignment. Regardless of the sequencing and mixing of the group experiences, there were discussions in half of the interviews performed regarding the importance of bringing the whole class together at the end of the experience for sharing and reflection.

Facilitation of the CBL experience. The next main aspect regarding how case-based learning is used in the different programs include issues surrounding the facilitation of the case-based learning experience. There were four main topics that emerged from the data regarding facilitation including who the facilitator is, as well as the type, quantity, and the quality of the facilitation provided the learner.

The role of facilitator in the case-based learning experiences described by the participants was most often held by faculty member. The participants described that this may

either be a core faculty member, an adjunct faculty member, or a clinician from a local practice. As was found in the study by Hay and Katsikitus (2001), the students tended to prefer facilitators who were experts in their field of study. This was also seen in a majority of the administrator and faculty interviews describing the expertise of those facilitating their case-based learning experiences. Students also demonstrated a preference for either faculty or clinicians who are actively practicing physical therapy at the time. One student remarked that,

When I know the facilitator is a clinician and is treating patients, and that's what we want to do, treat patients -- I feel it's better, I feel I have a stronger understanding or connection with that person than with someone who just teaches or does research.

Some of the participants described case-based learning experiences that were partially or wholly facilitated by students either formally or informally. With informal student facilitation, often times the groups would be given the patient case along with stimulus questions that they were to answer as a group. With formal student facilitation, this was described as in-class group work where the faculty member was present but not directly related to any of the groups. Instead, the groups would either assign or select a leader who would then facilitate the case discussion. As a whole, the students understood the rationale behind these different formats, but they preferred having a faculty member facilitate the group to a certain extent.

Other aspects dealt with the type and quantity of facilitation and feedback provided. One administrator discussed the importance of delayed feedback on facilitating case-based learning experiences by stating:

So, one of the things that I'm really trying to work on the faculty is to allow them to give the student time to process. Students in this day and age like answers quickly and they are used to getting to answer without having to work too hard to get them.... but really that's what needs to happen in terms of giving the student ample time to process the information.

The most common aspect of facilitation and feedback discussed dealt with the use of Socratic questioning during the case-based learning experience. This was described as the purposeful use of specific questions posed to the learners in order to direct them logically towards understanding of a particular content or learning objective. This type of facilitation was discussed in 16 of the interviews and proved to be the preferred method of facilitating the experiences. Another concept or technique utilized in facilitation was discussed that I termed bandwidth facilitation. This describes where the facilitator allows students to explore topics on their own, to a certain extent, and would not intervene to guide or lead them in any direction unless they got "too far off the beaten path". When asked to describe her facilitation style, one faculty member described the use of this bandwidth facilitation as follows:

In a large group it's more common for me to be more like a coach where I am kind of leaning them towards answers because it is a novel thing to do, and so I'm trying to give them a little more and kind of hold their hand down the path.... Then, when we go to the small groups, I really am trying to lob them a softball and say, 'let's see where you go with this?', and if you go on a tangent I might pull you back a little bit. But what I really want to see is what happens when you take this on on your own as a group.

Some of the participants also discussed how their facilitation styles changed as the learners progressed in developing the program. They described how they facilitated more closely and interjected more often for first-year students; whereas, they wouldn't interject at all if it wasn't required with third year students. This diminished feedback across the curriculum was posed as one method for increasing student independence as they neared the culmination of the program.

Finally, the quality of feedback and facilitation was addressed by a number of participants throughout the interviews. The most evident code regarding the quality of facilitation that emerged from the data was the importance of the facilitator having a clear understanding of the objectives and purposes of the specific case-based learning experience. Simply stated by one of the faculty members, "you have to know where you're going with it." Not all of the discussions, however, revolved around effective facilitation of case-based learning experiences. Two of the student focus groups gave examples of facilitation and feedback provided that was not only negative, but demeaning at times. They described how these experiences were not only unpleasant but would diminish their confidence level with professional and patient interactions. Alternatively, many instructors, like the one quoted above, viewed the role the facilitator as a coach or advisor who had the responsibility of providing support and helping guide the learner to knowledge. One discussion that came up in a number of interviews was how the facilitator might model clinical reasoning and problem-solving for the learner simply through selecting and posing certain questions to the student group during the CBL experience. A final aspect of quality discussed was traversing the balance between too much and too little facilitation. The students felt that with minimal facilitation

,they often felt lost and unsure of what they were supposed to be learning or doing. With too much facilitation, they often felt they were being lectured to rather than an active part of the learning experience. This balance will also be discussed as a major theme later in this chapter.

Barriers to Implementation of CBL in the Curriculum / Classroom

The second part of step four in Hammond's Goal-Attainment Model, as it applies to this research, is to assess the barriers of implementation of case-based learning in the curricula or classrooms of those programs studied. Through gaining an in-depth picture of ideally how the program is or is not intending to implement or use case-based learning, one may then assess the extent to which the intended outcomes were actually met in the program. Conclusions may be drawn that attribute the meeting or failing to meet these objectives to the ways in which the program was implementing the instructional method evaluated. A key component that was considered, however, was the barriers that exist which may have limited the appropriate implementation of the instructional method. Many of these barriers to implementing case-based learning were identified through the interviews with administrators, faculty members, and students. Four major categories of these barriers were identified including faculty and student buy-in, time requirements, setting characteristics, and personal attributes. Personal attributes included concepts such as personality style, learning style, an individual's abilities.

Buy-in from administrators, faculty, and students. In almost every interview, the participants discussed multiple positive aspects and outcomes of utilizing case-based learning in the classroom. It was also discussed however, that although case-based learning seemed to be an ideal tool to use in the delivery of physical therapy content, there were still a number of faculty members and academic programs that were not using this methodology. The most

common rationale for why individuals were not using case-based learning revolved around the idea of limited buy-in from either faculty or students. Because the issue of buy-in was so prevalent throughout the data, I felt as though it required its own subcategory, but most of the reasons for limited buy-in are actually described in the three following subcategories. An interesting point was made; however, that buy-in from all three groups of individuals is essentially required to adequately implement case-based learning in a physical therapy program. If the faculty member chooses to use case-based learning in the classroom but does not have adequate support from administration to allow for the increased time and physical space required to do it correctly, then it may fail. If that same faculty member with administrative support decided to implement case-based learning in the classroom but the students lacked buy-in, then the objectives of the case-based learning experience may not be met since the learner was not actively participating in them. Multiple codes that were identified in the data as being directly related to buy-in are discussed in the following sections including time requirements, setting characteristics, and individual personalities, learning styles, and abilities.

Time requirements. The most prevalent issue regarding buy-in seen in the data was the amount of time required in order to teach using case-based learning. Out of the 28 interviews performed, the concept of time requirement came up in 16 of the interviews, describing it is a major barrier to implementing and using CBL. In seven of those interviews, where time requirements were not discussed as a barrier, no other barriers were discussed either. This left only five interviews where barriers were discussed but no direct discussion of time requirements existed. Six main codes were identified through data analysis describing the

multiple aspects of case-based learning which required increased time to implement including the time it takes to create the case and case-based learning experience, to facilitate the case-based learning experience, to teach individuals to facilitate, to reflect on the case-based learning experience and improve upon the case for further use, and the increased time spent in faculty collaboration to plan and implement the case-based learning experience. It was almost unanimous amongst participants that case-based learning is a very time and laborious instructional methodology. One student stated his beliefs that the most efficient way to get a large amount of content to the learner in a short amount of time was through lecture. He went on to state that even though he was getting a lot of content, he felt he wasn't retaining or learning that content at all. This was a common perception amongst many of the participants interviewed. Thus, a cost-benefit relationship was identified between the quantity and quality of content delivered through different instructional methodologies. These concepts of increased time requirements for implementing case-based learning can be seen throughout, and possibly central to, all of the different barriers to implementation in the following sections.

Setting characteristics. Other major barriers to the implementation and utilization of case-based learning in the physical therapy classroom described dealt with specific characteristics of the particular school or program. Some of these included the number of core faculty on staff, the teaching load of the individual instructors, the class size of students, the availability and appropriation of funds required, and physical space limitations. Table 4.1 provides the demographic information of the academic programs studied. It can be seen that the physical therapy student class sizes ranged from 24 to 90 students and the number of full-time core faculty members ranged from 7 to 20. When discussing class size, many participants

described that it is more difficult to provide individualized instruction and feedback when the class sizes are larger. Some faculty described how they would split a larger class into two sections and teach the same material twice or have two different case-based learning sessions. Once again, it can be seen that teaching in this manner requires twice the amount of time from the faculty member. One faculty member described how this directly and negatively impacts the ability to utilize case-based learning as instructional methodology.

I will say that I came from another institution where we had a much heavier teaching load and fewer faculty and it was much harder there to do what I wanted to do than it is here. I teach one course this semester and the teaching load is much lighter. I can put a lot of effort into it and my energy is going just into that class. And I like teaching, so I'm going to put all of my energy into that class, whereas, if I had three courses that I teach then I would wonder how much effort I would put into it. I mean it's a class of 48 which is a little bit different because sometimes you teach two sections of the same class the same content but even when you're doing that back to back two hours and then two more hours that's a different scenario than having to go in and try to have just a real rich experience with one class.

With fewer faculty members on staff, each faculty member is responsible for coordinating and teaching increasing numbers of classes within the curriculum.

Earlier in this chapter, I described multiple formats of cases and case-based learning experiences commonly used in physical therapy education. Many of these formats require a certain amount of space and funding in order to be carried out. It was shown that the majority

of case-based learning experiences described by the participants were in small-group learning formats. Many of the participants discussed that in order to house these multiple small groups, it is best to have multiple small conference rooms with dry erase boards and other multimedia learning tools available to the learner. This requires a large amount of physical space within the department devoted to this group learning that can't be used for many other purposes. Some programs shared small conference rooms with other academic departments within their schools. While this solved the problem posed by the barrier, the participants discussed the difficulty of scheduling and reserving the small conference rooms for their students.

Other formats discussed included the use of standardized patients in case-based learning experiences. There is a high cost to the department incurred in the paying of actors to play the role of patients. The other barrier to the use of standardized patients is mere access. The use of standardized patients is becoming more and more popular in schools of medicine and is often available to other academic programs associated with the schools of medicine. Physical therapy programs who do not have this kind of association and availability may find it very difficult to find actors trained to portray medical patients.

One format of case-based learning not discussed or utilized by any of the participating schools but that was discussed earlier in this paper is the use of high fidelity patient simulators. These computerized mannequins are very costly to attain and maintain as well as require a large amount of dedicated space. The barriers discussed here have a large impact regardless of faculty or student buy-in and often require full administrative buy-in to be overcome.

Personalities, learning styles, and abilities. The last subcategory of barriers to the implementation and utilization of case-based learning in physical therapy curricula include

those related to individual personalities, learning styles, teaching styles, and skills of teaching and facilitating. Case-based pedagogy is very student-centered and constructivistic in its nature. Many participants alluded to the fact that in order to appropriately use case-based learning as an active learning tool, the instructor had to relinquish some of their power and control over the learning environment. Professors who are uncomfortable with this relinquished control are often uncomfortable with case-based learning as an instructional methodology. The same concept applies to the learners. If a student believes that it is the role of the professor to solely impart knowledge upon them rather than assume a certain amount of responsibility for their own learning, they will be equally resistant to learning through case-based methodology. This idea of the requirement of shared accountability on the part of the student and faculty was discussed in a large number of the interviews performed.

Of those participants interviewed, the most common differentiation made between those who are more apt to use case-based learning and those who are not dealt with tenure track and clinical track faculty members. A majority of those interviewed described how clinical track faculty members almost inherently prefer to teach with case-based learning methods. This is described in the following quote:

Clinical track faculty have no problem with buy-in - they're teaching and they want different ways to enhance their students' applied learning and want to get students engaged and see this as a huge avenue for success in that area.

One administrator described resistance from tenure-track faculty as follows:

There are others that have not bought in 100% because they don't want to take that much time in teaching their content - they want to do their research - you know folks who are more involved in research.

The following quote not only describes the difference between tenure and clinical track faculty, but also identifies another major barrier to buy-in from faculty exemplified by the quote heard more than once in the interviews, "if it ain't broke don't fix it."

The people who haven't done a lot of buy-in are those whose primary responsibility is research and so it may not be a priority of theirs to do something different in their courses when what they're already doing is working just fine for that and they have the outcomes for their students and there's not a whole lot of motivation to change fundamentally what you are lecturing or how you are lecturing in your courses.

In order to diminish the effects of many of these barriers involving personality, teaching styles, and learning styles, many participants discussed that they purposefully provided information up front regarding their use of case-based learning and problem-based learning methods when hiring new faculty or admitting new physical therapy students. Of all the barriers described, overcoming personality conflicts and resistance to case-based learning methods was described as the most difficult to overcome.

Measures Utilized in Assessing Outcomes of CBL in the Curriculum / Classroom

The fifth step of Hammond's Goal-Attainment Model entails the analysis of the results from the evaluation to determine the level of which the intended objectives and goals of the instructional methodology were met. In order to determine the level of perceived effectiveness

of case-based learning by the participants involved, I first had to identify the multiple methods they were currently using to determine the effectiveness of the case-based learning experiences. Both the administrator and faculty member participants discussed the difficulty in determining the effectiveness of any specific instructional methodology in practice. One faculty member discussed how their department is trying to perform actual educational research in order to assess the impact that their case-based learning experiences were having on their learners:

And so we don't really know if it's the CBL or if it's you know other things - we're trying to tease that out a little bit. We feel that it does help maybe it's just because we're really hopeful but our students are telling us that it is so.

Even though many of the participants discussed the difficulty in attributing any gains in the learner to any one particular instructional method, multiple avenues for assessment of learning with case-based instruction were discussed. In total 16 assessment methods were described in three main categories including objective measures of student performance, formal and informal program evaluations, and observations of learners by faculty, administrators, and students.

Objective measures of student performance. Some of the participants involved discussed the use of specific objective measures of student performance in providing feedback of the effectiveness of case-based learning experiences in the classroom. None of the participants described any formal educational research looking at outcomes of case-based learning methods versus traditional or other instructional methodology. As a whole, those describing the use of these objective measures to assess CBL effectiveness were making the

assumption that the outcomes were due to the instructional methodology used. Some of these objective measures included pass rates and raw scores on the physical therapy licensure exam, scores on the APTA's clinical performance instrument (CPI), outcomes on practical examinations, outcomes on written assignments, students' responses during facilitated case-based learning experiences, and learning portfolios. The CPI is a tool which is used by clinical instructors to measure student performance in the clinical setting and was the most common method described by the participants to measure the outcomes of utilization of CBL in the classroom. Half of the academic administrators interviewed reported using the national licensure exam scores since this exam is very case-based in how it is written even though it is multiple-choice in nature. Although the use of learning portfolios was raised by two separate interviewees from different programs, none of the programs in the study are actually using learning portfolios at the present time. These were mainly introduced as a way that the participants believed student learning may be better assessed and case-based learning may be better evaluated. One faculty member participant stated that she believed that concepts learned through case-based learning is best assessed through the use of short answer or essay questions since the objectives are looking more at how student process the information and make decisions rather than specific content knowledge. She did mention that this made it very difficult to grade and provide individual feedback because of the time-consuming nature of grading essay questions.

Formal and informal program evaluation. Many of the participants discussed using formal and informal program evaluation methods in soliciting feedback regarding the use of case-based learning from present students, recent graduates, and employers of recent

graduates. Participants from seven of the eight programs studied described using different methods of receiving feedback from the learner regarding the use of case-based learning in their programs including student evaluations of teaching (SETs), evaluation forms specific to the learning experience, and overall curricular review during exit interviews of graduating students. Other participants discussed informal methods of receiving feedback from recent graduates and employers of recent graduates including conversational discussion and chance meetings.

Informal observations and assessments of learners. The final method used to assess the outcome of case-based learning described by the participants was informal classroom observations and self-assessments of learners. Of these, the most commonly discussed method was the informal observation of student nonverbal communication and body language by the faculty facilitators during case-based learning experiences. For example, one faculty member noted:

I think it's seeing them do something that I know that they're going to do professionally and carry that from the beginning to end. Also, with some feedback with regard to their satisfaction as well that they know that they can do this from beginning to end in a skill that's related to what they got into the profession for. For making them do something that they're never going to use or that doesn't relate then yeah I think that I may get resistance but I think intuitively they know because they've seen it, have enough experience that they know that they have carried this out. And so, I guess that gets into the inherent buy-in to it, because they know that this is going to be expected of them when they get in their clinicals and they want to do well.

In this discussion the participant was talking about what he sees in the learning experience that lets him know that the students are learning from the experience and thus makes it worthwhile to perform. Above, he describes that he may feel resistance from the learners if they were not bought in to the learning experience. He further stated:

If I don't prepare and get things set up, you don't see the buy-in and again you see some of that resistance or just not really wanting to engage in activity then you know that this just wasn't really working.

Many other participants described some of these intangible feelings and observations of the learners in providing them with feedback individually that it works. Multiple participants described the “aha moment” when the learner understands a concept completely for the first time and multiple pieces of a puzzle just fell into place. They described this often when asked the question, “is it worth all the effort that it takes to teach this way?” It was evident in the data that these informal and intangible sources of feedback were as important, if not more important, to the participants than any other method of assessment discussed.

Actual and Perceived Outcomes of the Implementation and Utilization of CBL

The Hammond’s Goal-Attainment Model culminates with a final analysis regarding the level of attainment of the intended objectives and outcomes identified in step three. The main objectives identified were that through the implementation and utilization of case-based learning in the physical therapy curricula studied there would be an enhancement of the learning of physical therapy content, enhanced clinical reasoning skills of the learners, and increased ability of the learner to apply knowledge to the clinical setting, and that the concepts of lifelong learning would be fostered within the involved learners. Through analysis of the

interview transcripts, 37 codes were identified that described all of the actual and perceived outcomes that the participants attributed to the implementation and utilization of case-based learning within their academic programs. Some of these codes described the direct feedback from the program evaluation methods described before with regards to the case-based learning experiences utilized in their programs.

Individuals from over half of the programs studied reported overall positive student feedback regarding the use of case-based learning. Some of the benefits to the program that were described as positive outcomes included the fact that faculty were collaborating with each other more often, faculty were enjoying teaching more in this manner, and at the program was able to perform curricular reviews through the application of the cases. Many of the participants described that by facilitating a case-based learning experience that a faculty member was able to determine whether or not the class as a whole grasped certain aspects of curricular content already taught. Through this they were able to identify multiple areas that may need improved upon in the curriculum as well as areas that may have been left out altogether.

Of the remaining codes, 26 dealt with the direct outcomes of the learners in the case-based learning experiences. These were categorized into four major topic areas that were very similar to those categories of the intended objectives described above. They included codes of text dealing with outcomes demonstrating improvement of students' learning, professional interactions, clinical reasoning skills, and increased preparation of the student for entering the role of a clinical physical therapist.

Improvements in learning. Out of the data analyzed, seven codes emerged regarding the improvement of student learning through the implementation and utilization of case-based learning methodology. One of these discussed was the high pass rate and raw scores on the national licensure exam for physical therapy. The participants describing this outcome an overall outcome of student learning and realized that it couldn't be directly attributed to case-based learning methodology alone. They did make the assumption that CBL experiences the students had most probably enhanced their thinking during the exam since the board exam questions are mostly cased-based in nature themselves.

The other codes identified included an observed increase of the students' independence in the learning process, and increased ability of the student to grasp and understand CBL assignments, increased abilities with peer teaching and learning, increased connections between content and patient examples, increased carryover of learning, and increased retention of knowledge. The last three of these codes were discussed heavily by the students of the different programs studied through the student focus group interviews. Four of these groups discussed the outcome of building connections between specific physical therapy content and patient case examples as a main contributor to increased retention and carryover of this knowledge. Five of the student groups reported that content discussed during case-based learning experiences directly and positively impacted their ability to carry over or apply this content in the clinical setting during their clinical affiliations. The unique ability of case-based learning experiences to reinforce content knowledge in the learner was raised in six of the student focus groups as well as in five other individual interviews.

Improvements in clinical reasoning. The most frequently discussed outcome attributed to the implementation and utilization of CBL in the classroom was the enhancement of the clinical reasoning skills of the students. Four main codes existed under this subcategory of outcomes including improved clinical reasoning skills, increased inquiry into unknown knowledge, increased efficiency with examination and differential diagnosis, and the presence of a learned process for figuring things out. Of these, the most prevalent code discussed in the interviews was the increased efficiency with examination and differential diagnosis. One faculty member described:

I think the students definitely think better on their feet. They don't look to be taken by the hand through the process. They learn to be independent and faster. Having taught in a very traditional, lecture-based curriculum where the students would not make a move without an instructor telling them to, to where they come into class and they know what's expected of them and they come in the lab and start practicing. ... They are much more independent. I know when they go out on clinic our clinical instructors see that too.

This code was discussed in seven of the eight (88%) student focus groups and 14 (66%) of the interviews in all. The remaining three codes were each discussed in five of the eight student focus groups demonstrating a strong positive outcome identified by a majority of the learners.

Improvements in professional interactions. Another category of outcomes that emerged from the data were attributes that demonstrated an improvement in the students' professional interactions with other healthcare professionals, patients, and patients' family members. Eight codes were identified within this subcategory including improved interpersonal skills, a greater

understanding of professional issues, a greater understanding of the profession of physical therapy, more effective professional interactions, the increased ability to connect with the patient, an increased understanding of empathy, an increased ability to treat the whole patient, and a learned ability to self-assess one's own biases and emotions. Of these, the most commonly discussed was improved interpersonal skills and professional interactions. One student described how their interpersonal and professional interactions were enhanced through case-based learning in the following quote:

So even just getting to that comfort level at being able to sit down with the patient and knowing that you already know what to say because you practiced that – because you used cases that have made you practice that really is very beneficial. So in my opinion, yeah it does work.

One of the main purposes for implementing and utilizing CBL in the classroom described earlier in this chapter was to increase the students understanding of professional issues, such as the impact of a patient's psychosocial and family history. One faculty member discussed how feedback from clinicians and student evaluations of teaching demonstrated an improvement in their students that they attributed to the implementation of CBL:

One of the things that students noted was that they had more of an awareness of ethical issues and psychosocial dimensions of the patient sitting in front of them for the first time. They said even more so than their clinical instructor appeared to have outwardly an awareness of those things on their initial visit. The students were already in the mindset that they needed to consider when they asked the patient what their goals are for instance for physical therapy do

they need to ask further about what family goals might there be. And they seem to be more aware of that especially in their second clinicals than they were in their first because they had had psychosocial and ethics coursework as well.

Once again, strong evidence exists in the data that supports the meeting of this intended objective of increased interpersonal skills through the implementation of case-based learning in the physical therapy classroom.

Increased preparation to enter the clinician role. The last subcategory of outcomes learners attributed to use of case-based learning instructional methodology is the increased preparation of the student to enter the role of a physical therapy clinician. The seven codes identified that described this increased preparation included the following: decreased fear of failure, an increase in number and quality of tools for practice, greater independence in treating patients, a broadened experience with and scope of patient diagnoses, increased comfort in the clinical setting, increased confidence, and an overall increase in the preparation of the student for clinical rotations. Many of these codes were only discussed directly in a few of the interviews, however, they were alluded to in the interviews by discussing many of the other outcomes previously described in the sections above.

The overall goal of physical therapy education is to prepare an individual to enter the role of a professional physical therapist. Therefore, a majority if not all intended objectives of the learner ultimately is directed at this outcome. Given all 26 codes described above demonstrating positive outcomes of the learner attributed to the implementation and utilization of case-based learning, it would logically be seen that these methodologies have led to the increased preparation of the students to enter the profession of physical therapy. The

following sections describe the themes and relationships identified through further analysis of the codes and categories that have been presented. The relationships identified will demonstrate how effective implementation and utilization of case-based learning in the program studied have led to this increased preparation of the student to enter the role of physical therapist.

Themes and Relationships

Through an in depth data analysis of the field notes and interview transcriptions collected from 28 individual and focus group interviews and two classroom observations, over 200 codes were identified in 21 different categories. These codes and categories were defined and discussed in the previous sections. These codes were further analyzed to identify the themes and relationships that exist between the categories found in the data. Four main themes were found that exhibit different mechanisms by which effective implementation and utilization of case-based learning in physical therapy curricula may lead to the increased preparation of a physical therapy student to enter the role of a professional physical therapist. These themes include the notions of making the learning experience *real*, making the learning experience *safe*, finding the right balance between too much and too little information and facilitation provided, and building the confidence of the learner. The following sections provide an in-depth description of these themes and relationships.

Making it Real

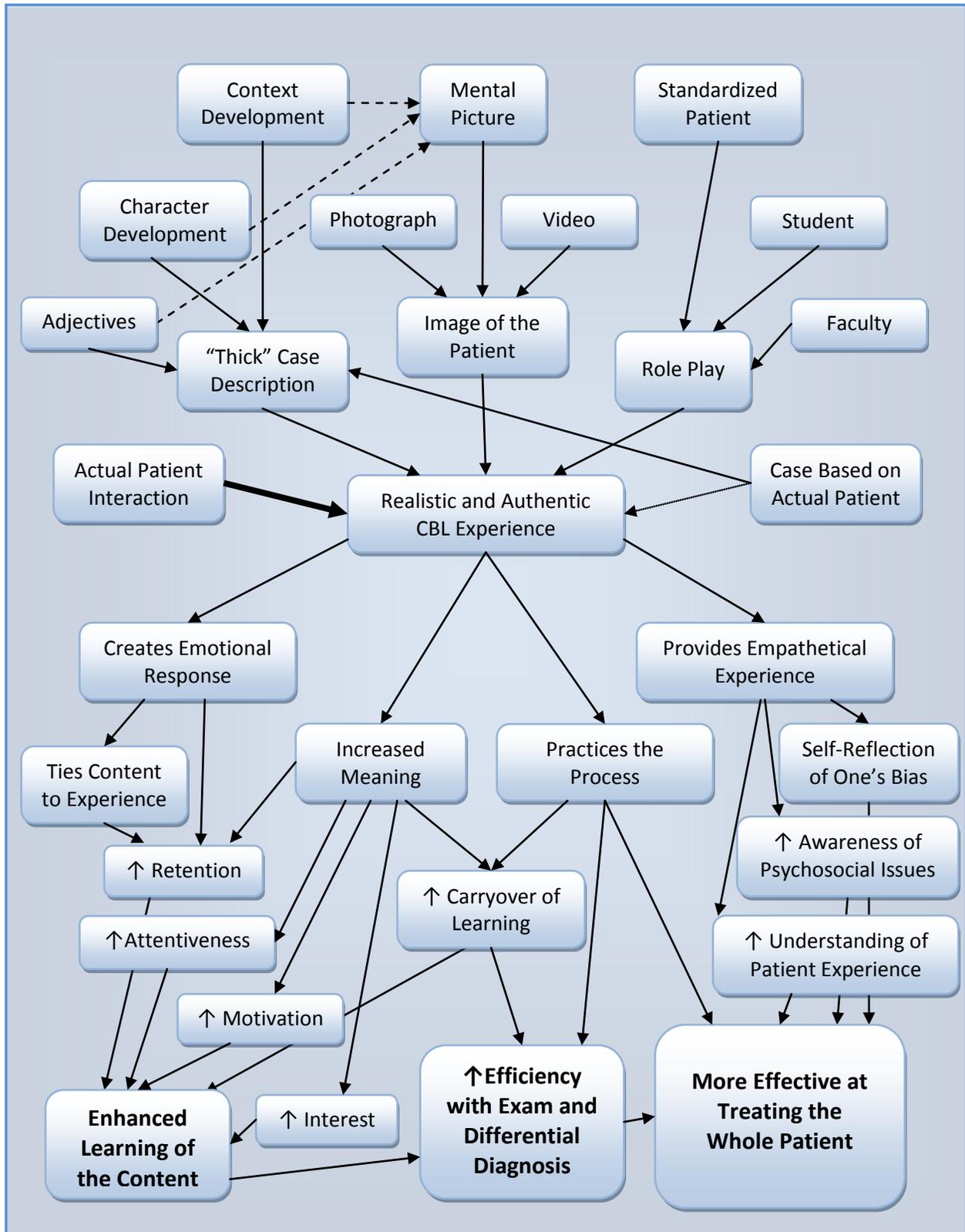
The first main theme that emerged from the data regarding effective use of case-based learning was the principle that in order to most positively affect the learning outcomes of the student one must create a learning experience and environment that is both realistic and

authentic. Figure 4.2 provides a model of how effective case development and case-based learning experience structure can lead to this realistic and authentic case-based learning experience. It further depicts how this realistic experience directly and indirectly affects student learning and interpersonal relationships. This section will describe the general tenets of this model.

Many of the aspects of effective case design and case-based learning experience development discussed earlier in this chapter can be seen at the top of Figure 4.2. The most effective format for creating a realistic and authentic experience is obviously when the student has direct interaction with an actual patient. This relationship is denoted in the model with a thick arrow leading directly to a realistic and authentic case-based learning experience. In writing and designing a case, it has been discussed how the use of multiple adjectives, extensive character and context development, and basing the case on a real patient all lead to a more realistic experience for the learner. One participant likened this development to qualitative research in that you are creating a "thick description" of the case in order to provide the learner with a much deeper understanding of the patient's situation and experiences. One student expounded on this level of description as follows:

You get more of a dynamic perspective on the person. Especially, in any kind of a medical field - you can sit there and say, 'Well this person has a herniated disc and this is what we would do to treat a herniated disc.' But in the real world with a real life scenario, there are ten other factors that go into that you know: pre-existing conditions, other health conditions, medications, stress levels, work

Figure 4.2. Concept Map of Effect of Realistic and Authentic CBL Experiences



environment, all of those things. So this person's history, work environment, and things like that which are presented to us in these cases give us a more real-world perspective on that person rather than just saying 'Oh well, here's Joe Schmo with a herniated disc. What do you do for him?' You can really look at all of the different factors that are involved in treating that patient.

It was brought up often in the interviews how this thick case description can create a mental image or picture in the learner that helps the learner connect with the patient. Many participants used metaphors such as "visualize", "snapshot", "paint a picture in your head", and "picture of a patient" when describing this visual connection with the patient. This is seen in the following quote regarding this thick description:

I think it helps you remember the face of a person to put to a situation; I think that that helps me remember it. I can look at a piece of paper and read it all day and still not retain everything on the piece of paper, but if it is like a semi-real-life situation and we know that there is going to be a patient that has at least part of this aspect to them, it helps me to remember – to trigger it. I can link it to other patients. Kind of putting a face to the problem and so you're like, 'Oh yeah, so-and-so had that. I remember that.'

Some faculty members would use photographs and video in order to promote this connection and real experience of the learner. Other case formats that were attributed with increasing the authenticity of the learning experience included role-play via standardized patients, fellow students, and faculty facilitators.

The participants described many mechanisms by which the quality of the real and authentic case-based learning experience positively affected their learning outcomes. One common mechanism was that it created an emotional response in the learner. The following quote illustrates this nicely:

We noted that there are some very strong feelings that our students have tied to the individuals that are used in cases in her (another faculty member's) class and if I use them in an ethical dilemma in my class, those feelings come out....I mean it was so tied into that ... lecture that they had done, that this picture of some guy and that feeling coming back to that student about (the patient) is a really powerful thing to be able to carry across courses from a spring semester course to a summer. And she remembered that. And we had a much more deep discussion that day about the ethical dilemma that his face was tied to than we had the previous year when I didn't use that case.

The participants also postulated that a more realistic case-based learning experience meant more to them and thus, they were more interested, motivated, and attentive during the learning experience. The model shows how all of these aspects come together to enhance the overall learning of the students.

It was also seen that the more realistic the case scenarios were, the more they provided the learner with a true experience of empathy. This empathetical experience in turn gave the students an increased understanding of the overall patient experience, increased awareness of all of the psychosocial issues involved with patient care, and

allowed them to reflect on their own beliefs and biases regarding patients. The following student describes this self reflection as follows:

It also lets you know what your biases are beforehand so you don't put those on a patient in the future. It exposes you to a situation prior to an actual situation where you may have these negative feelings but you know how to decrease them or not put them onto your patient.

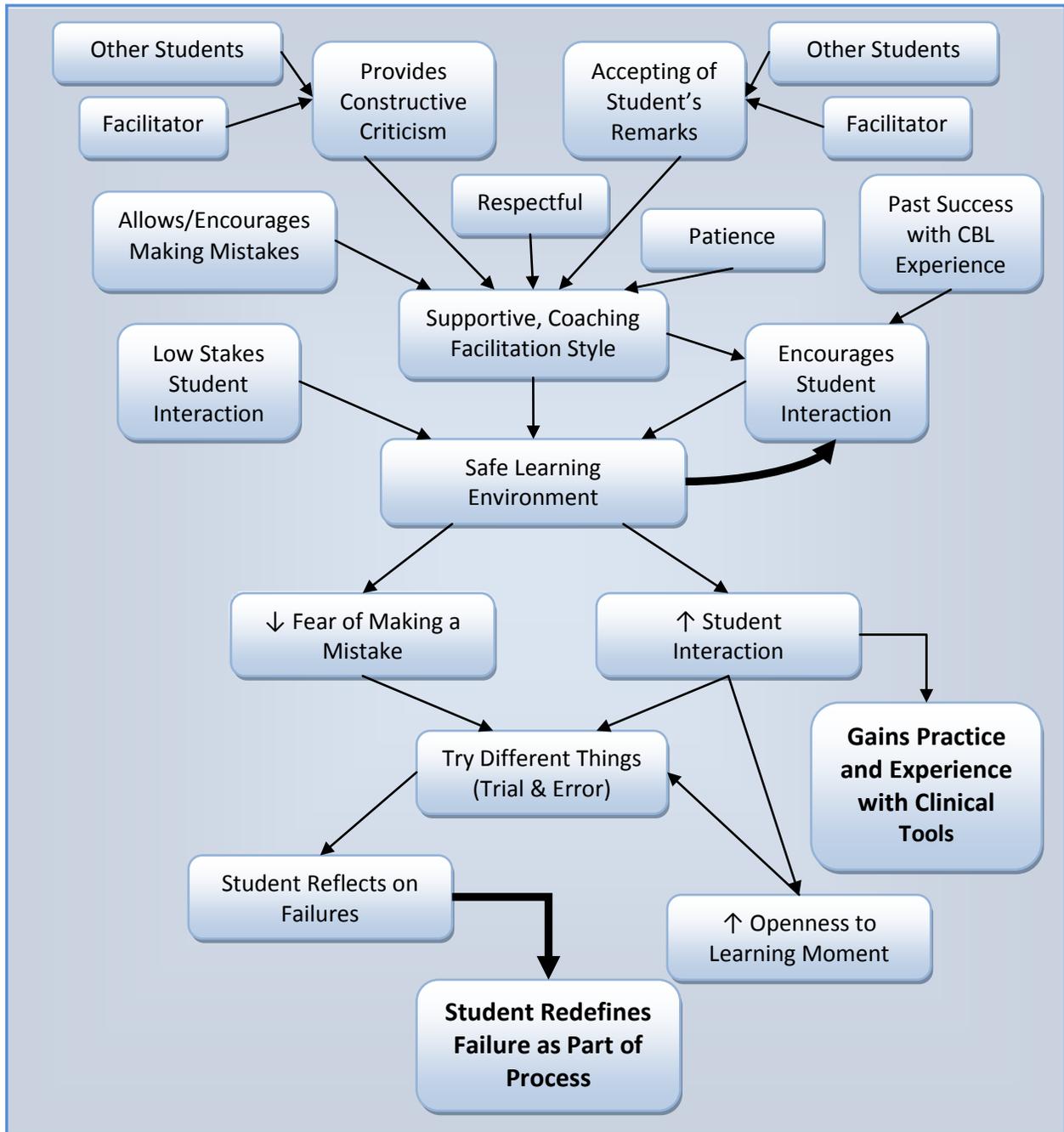
Another outcome of a realistic and authentic case-based learning experience is that it allows the learner to practice the process of physical therapy patient treatment either mentally or physically. The model in Figure 4.2 shows how this mental or actual practice helps to increase the carryover of learning from the classroom to the clinical setting. It goes on to show how all of these attributes of learning lead the learner to being more effective at treating the overall patient.

Making it Safe

The second major theme that emerged from the data analysis involved how the creation of a safe learning environment in the case-based learning experience positively impacted the development of the physical therapy student. Figure 4.3 introduces a concept map depicting how multiple aspects of the case-based learning experience structure and facilitation led to the creation of this safe learning environment, as well as, the impact that this safe learning environment had on the outcomes of the students.

Many participants, including both instructors and students, discussed the importance of creating a safe environment to positively impact the learner. A number of participants discussed multiple case-based learning formats that were assessed directly by the instructor

Figure 4.3. Concept Map of a Safe Learning Environment in CBL



and had large impacts on the grading and academic progression of the student. Obviously, the use of cases in assessing the learner through practical examination creates a high-stakes learning environment. Even though the primary purpose in this case application is to assess the

learner's knowledge and performance, many of the faculty and students described these as learning experiences as well.

Some students described how they were graded in small-group learning experiences based on their level of participation, preparation, and knowledge displayed during the learning experience. These student groups described how the application of this high-stakes environment actually detracted from their overall learning experience. Some students described how they spent more time worrying about speaking up and saying the right thing than they did on actually learning the material. Instructors who selected not to implement these high-stakes methods reported multiple ways of motivating their learners other than the extrinsic motivator of grades.

The most impactful aspect leading to the creation of a safe learning environment is a supportive and coaching facilitation style. Some of the main qualities associated with this facilitation style include patience, respect, allowing and even encouraging the learner to make mistakes, providing constructive criticism, and being accepting of students' remarks. Not only is it important for the facilitator to demonstrate these qualities during the learning experience, but the students should be respectful and demonstrate the same courtesies to each other in order to truly foster this supportive and safe environment. One faculty member described her facilitation style that she attributed to creating a safe learning environment as follows:

So I think listening very carefully is important. I think that encouraging making mistakes is very important for case-based learning or PBL or whatever else kind of learning because you're creating an atmosphere of well just throw it out there don't worry if it's right or wrong because I think their minds get opened. I think

if you provide that environment. So to just periodically saying "to say whatever is on your mind". I think that part of the job is to try to sensitively draw out the people who are not contributing. And some need to build confidence and their ability to speak because often they'll be the person to come out with something brilliant. And we'll be like that's perfect that's right on. So you also need to build their confidence.

A key aspect of a safe learning environment is that it encourages students to interact and be active in their own learning process. This is directly impacted by the facilitation style of the instructor as well as the student's past history of success with similar case-based learning experiences. As the student interacts in this safe learning environment they are further encouraged to continue interaction as well as to encourage the interaction of their classmates. This creation of a safe learning environment not only encourages the students to interact more freely, it also decreases the students' fear of making mistakes. For instance:

It takes the fear out of trying new things and trying different ideas that you might have because you've tried them and you seen that really okay what is the worst that can happen – *here?*

In turn, this encourages and allows students to try new and different techniques as well as increases their openness to learning new things. One student describes this as follows:

I think by being able to try different things on the professor, having that motor experience of actually trying it whether it's on your professor or your partner, you feel what it feels like to do it. And you feel what it feels like when it works. I

think that if I can get it to work with my professor, then I feel confident that I can get it to work with my patient.

Through this increased student interaction and the application of trial and error reasoning, the student is able to learn from errors or failures and gains vital experience with practicing clinical tools. These concepts of trial and error and the redefinition of failure are further described later in this chapter as part of the theme of confidence building.

Balancing Acts

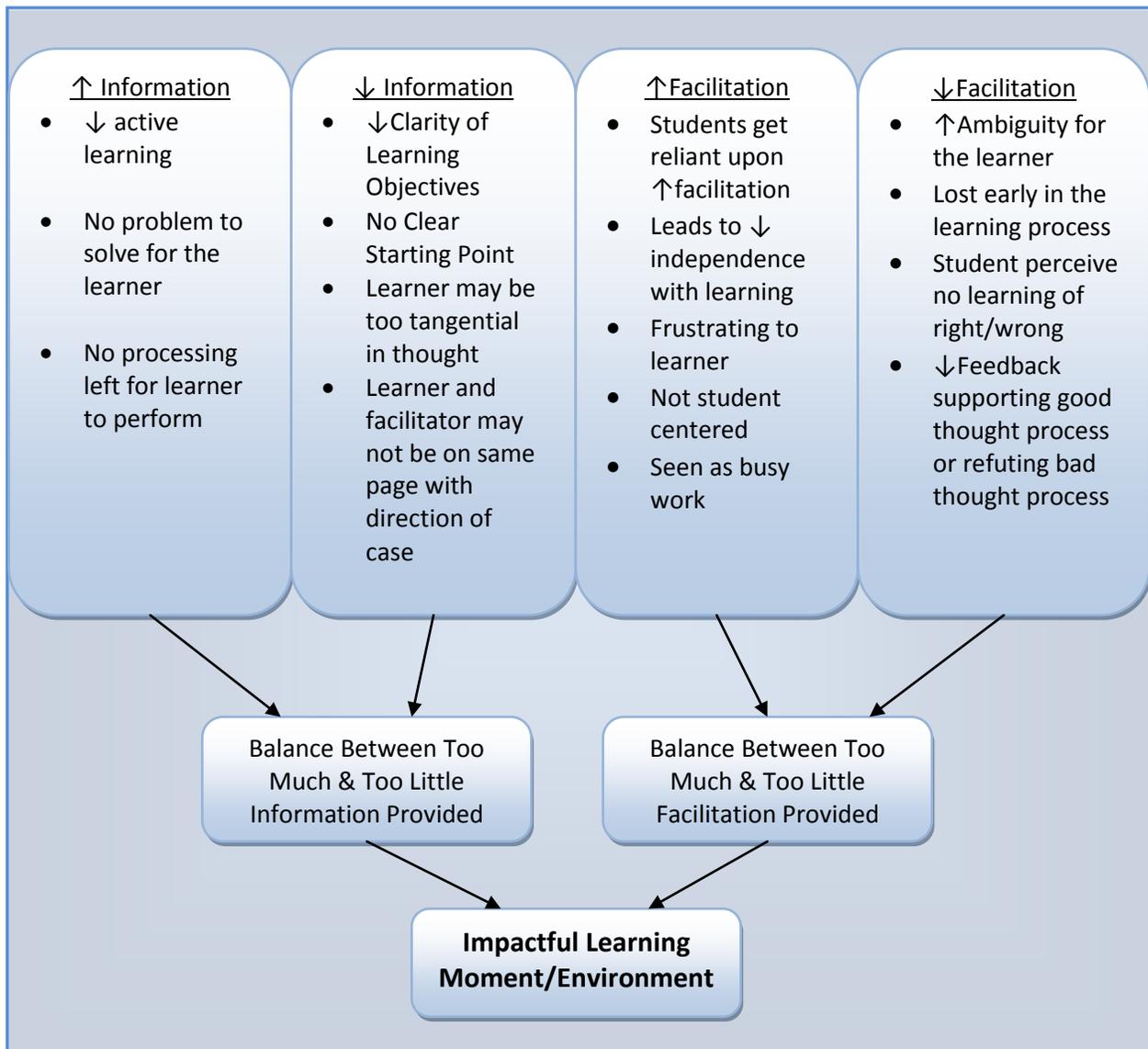
Another main theme that was prevalent in the data involved the delicate balance between too much and too little information and facilitation provided during the case-based learning experience. Figure 4.4 illustrates the detrimental outcomes of excess or insufficiency in any of these four realms.

In designing a case to be used in a case-based learning experience, a major aspect that must be considered is the amount of information to be provided to the learner about the case. The following is a discussion between two students during a focus group interview in which they described this intricate balance between excess and paucity of case information:

P1S3: The fact that you are only given the beginning of the picture - you are only given the subjective and the objective really, you're not given the whole assessment plan and you have to take those pieces and put them together.

P1S5: But you are given enough to start thinking. Usually they give you just what you need to generate more questions. What is frustrating is when you don't have enough and we sit here and think that they need to give us more because we're students and we haven't ever seen this before. But to the professor it

Figure 4.4. Concept Map of Balancing Acts of Information and Facilitation in CBL



might seem very clear because they've seen it a million times. I think that they have to give us enough to go off of.

P1S3: Enough but not too much - just the right amount.

When facilitating the case-based learning experience, the same sort of balance is required between too much and too little facilitation during the experience. One faculty member

described the ends of this spectrum as being “directive” and “self directed.” She described the directive style of facilitation as:

I consider directive where it is faculty taught, where the faculty is telling the students the key information - the important things. What you do with it is really talking *at* the students more rather than engaging them in discussion. I've certainly sat in a lot of classrooms where it's still it's almost like a lecture but you just happened to be sitting around in a circle. But the faculty is doing most of the talking and telling them from their own knowledgebase.

Conversely, she described the self-directed learning facilitation style as:

Self-directed learning is where there is a facilitator of learning - someone who has the information, knows the content as such, but their role really is to draw out what the student knows and what the student needs to know. Guide them to where the end product is. And so the teaching method is what you do in the classroom or the time you spend with the students either online or in person to get them to the knowledge that they need to get to, but you don't give them the knowledge.

Even though it can be very difficult, finding this balance of just the right amount of information and facilitation provided to the learner is vitally important to creating an effective and successful case-based learning experience.

Confidence Building

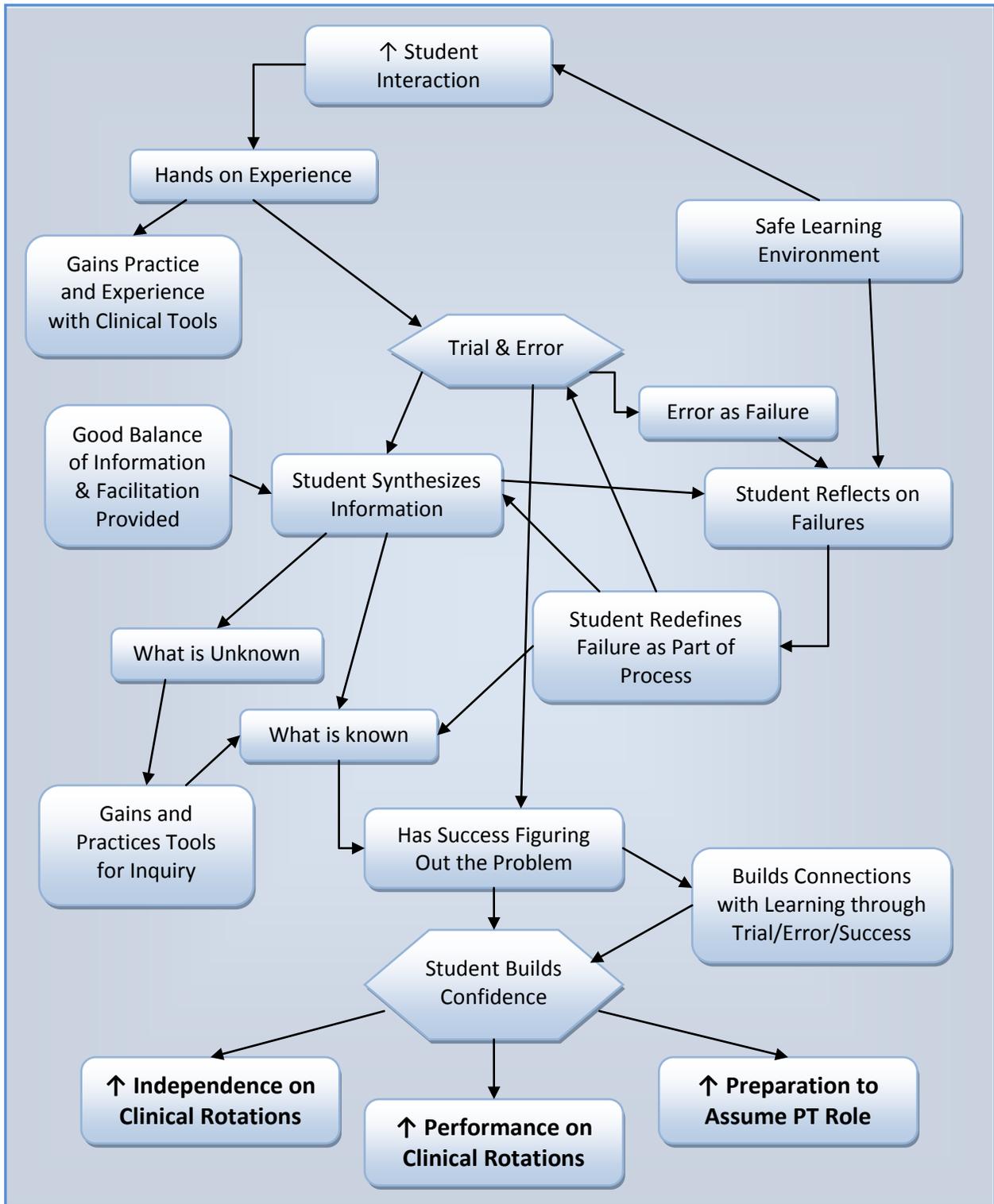
The last major theme identified through data analysis was the direct impact of confidence building on the positive outcomes of the learning experience. Figure 4.5 provides a

concept map that depicts the detailed process by which the learner is able to build confidence through the effective application of a case-based learning experience and ultimately become more independent, skilled, and prepared for clinical practice. This model can be seen to be an extension of the previous two concept maps discussed in this chapter. As stated before, the development of a safe learning environment increases student interaction and allows them to engage in trial and error practice and reasoning. When the student attempts something new and experiences a success, this directly impacts their learning as well as builds their confidence in their own clinical reasoning skills. The following quote describes how this success can have a strong emotional impact upon their learning.

I think that it's kind of an emotional attachment as far as a success, because you actually were able to figure it out and critically think and work yourself through what you needed to do and come up with a good solution or an answer - so it's kind of that feeling of success for me too that helps it retain in my memory a little better.

On the other hand, when the learner tries something new and it doesn't work or doesn't lead directly to a success, the student initially interprets this “error” as a failure. In the confines of a safe learning environment that is accepting and supportive of failure, the learner is urged to reflect upon that failure. The following quote from a student illustrates how reflection on failure in a safe learning environment leads to a redefinition of the concept of failure in clinical practice.

Figure 4.5 Concept Map of Confidence Building through CBL



For different techniques that you have tried three or four different times when you go through that case-based before you get one to work you know when you get in the clinic it's not a big deal if you try one thing and it doesn't work right away. You don't look at that particular patient and think, 'Oh, I don't know what I'm doing because the first thing I tried didn't work.' You look at the patient and go 'Oh well that didn't work let's try something different.' And then builds that confidence to have that experience to have you know - it's not a failure it just didn't work.

Once the learner gains the understanding that error is a very important part of the equation in hypothetico-deductive reasoning, they learn to synthesize the information gained from the trial and error experience. With the assistance of an appropriate balance of facilitation and information provided, the learner is able to identify what is known and unknown. If, through reflection they are able to see what is known and figure out the problem, this in turn will lead to increased learning and confidence building. If they synthesize the information from trial and error and still have unknowns in the equation or problem, they are then responsible for seeking out information to help answer the questions. Through this process they are able to learn, gain tools for, and practice the process of inquiry. Once they discover the answer to that which was unknown and are able to successfully figure out the problem of the patient, this once again leads to enhanced learning and confidence building. Ironically, the more the learner reports having to struggle through this process initially, the more impactful the learning experience seems to be. As can be seen on the concept map, the ultimate outcomes of this process are increased independence, clinical performance, and preparation for entering the PT profession.

Summary

In this chapter, I presented the five steps of Hammond's Goal-Attainment Model and how it was utilized to evaluate the implementation, utilization, and perceived effectiveness of case-based learning in the curricula of eight physical therapy education programs. First, I presented the demographical information of the academic programs and individual participants involved in the study. I provided a thorough description of how the programs were using cases in teaching and presented the rationale behind and expected outcomes of this implementation and utilization of CBL within these programs. Barriers to the implementation and utilization of CBL that were identified by the participants were listed and defined, and the multiple measures utilized by the programs in assessing the effectiveness of CBL were presented. I then described the multiple learning outcomes reported by the participants which they had directly attributed to the use of case-based learning methods. Finally, four major themes were introduced which demonstrated how the effective implementation and utilization of case-based learning in physical therapy curricula can directly and positively affect the overall outcomes of the student.

Chapter Five

Discussion

Overview of the Study

The purpose of this research was to identify how selected physical therapy programs across the country were using cases in teaching physical therapy content to their learners. I was interested in understanding the experiences that the individuals have had in creating cases, scheduling and planning case-based learning experiences, carrying out those case-based learning experiences, as well as what they believed the student gained through those experiences. I was interested in learning the extent to which administrators were supportive of the use of or were requiring or suggesting using case-based learning as instructional methodology in their respective curricula. I was also interested in finding out how open and accepting the students were to this kind methodology and whether they preferred this methodology compared to traditional lecture or other learning experiences. Finally, I was interested in learning how case-based learning may be improved upon in order to make the learning experiences more meaningful for the learner, enhance or increase the retention and the transfer of knowledge of the learner, as well as assisting the learner to attain new knowledge. The research questions that I was looking to answer through this study specifically were as follows:

- To what extent are the selected physical therapy programs studied utilizing CBL in their curriculum and what different ways are they formatting, structuring, and applying CBL in the classroom?

- What are the factors that impact the effectiveness of implementation of CBL and what indicators exist that denote effective implementation of CBL in the selected physical therapy curricula?
- What is the perceived effectiveness of CBL in delivering physical therapy curricula by physical therapy students, faculty, and administrators of the selected physical therapy programs?

In order to answer these research questions, I decided to perform a qualitative study to evaluate the use of this instructional methodology in physical therapy programs from multiple perspectives including those of administrators, faculty members, and students.

In total, eight academic programs from four different states across the country were involved with a total of 68 participants who were interviewed. The administrators and faculty members were interviewed individually while the students were interviewed in focus groups. Interview and focus-group moderator guides with specific questions as prompts were used during data collection; however, I also used an emerging-questions design, which gave the participant the freedom of discussing what they felt was most important to them and allowed this to partially guide the interview. Data analysis began during the interview process and continued after all interviews had been performed. Through this data analysis, over 200 codes emerged from the data in 21 different categories as seen in appendix I. In performing the data analysis, I used the Hammond's Goal-Attainment Model, which is a program evaluation strategy aimed at evaluating one particular portion of a program or programs. As part of this model, I ascertained the purpose for implementing and using case-based learning by faculty and administrators as well the perceived purpose for its use by students. I also identified the

multiple different ways that case-based learning was being used and structured within each program including how they were formatting their cases, grouping their learners, facilitating the experience, and sequencing the experience within the course or curriculum. In asking about the purpose of the use of case-based learning I was also interested in what the intended outcomes from the learner were as described by faculty and administrators. As well as finding out the different ways that they were using case-based learning, I was also interested in asking about the different barriers that existed, or potentially could exist, which may limit the effectiveness or the utilization and implementation of case-based learning in these programs. Finally, I asked the participants to inform me of any outcomes they had observed through the utilization and implementation of case-based learning. As the last step of the Hammond's Goal-Attainment Model, I analyzed all the data described before to evaluate how well case-based learning had met its expected outcomes in the physical therapy programs, as well as to identify major issues that impact these outcomes either as a support or as a barrier. A detailed description of the findings may be found in the previous chapter. The following sections provide a general discussion of these findings as they relate to the current body of knowledge regarding case-based learning.

Evaluation Findings Outcomes

With regards to the outcomes of the evaluation findings, it was found that as a whole, case-based learning, if appropriately implemented, is an effective method for attaining educational outcomes leading to the professional preparation of physical therapists. McGinty (2000) proposed that case-based learning was "uniquely appropriate for adult learners and for the professional education of health care providers, specifically physical therapists." The

findings of this study not only provide support for this statement, but they also provide strong evidence of the different mechanisms that she described by which case-based learning may enhance the educational preparation of physical therapists. Regarding the purpose and objectives of the utilization of case-based learning in physical therapy curricula, the participants described four major areas directly impacted by case-based learning. These included creating a better assessment of student learning, increasing the learners' ability to apply knowledge in the context of physical therapy practice, the enhancement of learning physical therapy content, and the enhancement of the students' clinical reasoning process. The four main areas reported by the participants regarding how case-based learning actually impacted the learning of the student included the postulates that case-based learning increased the students learning capacities and abilities, enhanced their clinical reasoning skills, helped them be more proficient and effective with professional and interpersonal interactions, and better prepared them to enter the role of the physical therapy clinician.

Enhanced Student Learning

The findings of this study suggest that administrators, faculty members, and students alike all felt as though case-based learning enhanced their overall learning of physical therapy content. As a majority, the CBL experiences were used to reinforce knowledge already learned through application to clinical scenarios. When the participants were asked to describe how they knew that CBL was working to enhance learning, they provided a number of methods for measuring these outcomes. A few of the administrators and faculty reported high scores and pass rates on the physical therapy licensure exam of their students. Even though this couldn't be directly correlated with the utilization of CBL, the participants made the inference that

teaching with cases helped prepare them for the exam since the board exam was mostly comprised of case scenarios. Many researchers found similar findings when looking at board exam scores and pass rates for students in case-based or problem-based programs (Beachey, 2007; Distlehorst & Robbs, 1998; Richards, et al., 1996; Whitfield, et al., 2002). The participants also listed examination scores, both written and practical in nature, as evidence for the effectiveness of CBL in positively impacting student learning. This is similar to that reported by Finch (1999), who compared tradition and problem-based curricula with regards to written and essay scores and found that there was no significant difference in the biomedical knowledge of the learners from the different programs. He did report that the students in the PBL program did significantly better on the essay exam. This correlates with the fact that some of the participants in the present study suggested that short answer and essay are the best way at assessing the intended outcomes of CBL.

Many attributes of case-based learning that lead to the enhancement of learning were also identified through data analysis including its ability to actively engage the learner, increase learner motivation, create connections between theory and clinical practice, give the learning process meaning, provide multiple mediums for delivery of content to address diverse learning styles, situate the learning within the context of real physical therapy practice, and to increase the depth of the overall learning process. O'Neill, Morris, and Baxter (2000) found similar findings through surveying students in clinical clerkships in medicine in that case-based instruction stimulated their learning, increased their motivation to learn, allowed them to link clinical experience with other knowledge, and overall helped with their learning. Hayward and Cairns (1998) utilized qualitative research methods very similar to the present study to

investigate physical therapy student perceptions of CBL in one academic program. These researchers found that the students preferred CBL over traditional lecture in the delivery of physical therapy content. Their participants reported that CBL increased their active involvement in the learning process, their intrinsic motivation to learn, as well as their overall interest in the content and material learned. They also believed that case-based learning required them to integrate and reinforce knowledge previously learned as well as knowledge they were concurrently learning in the curriculum. The participants also described the importance of the role of context with regard to CBL in that it provided a realistic experience of what they will be doing in clinical practice. Overall, these participants believed that CBL increased their transfer of knowledge into the clinical setting which is the ultimate goal of physical therapy education.

Enhanced Student Clinical Reasoning

Another major evaluative finding was that the expected outcome of improving the clinical reasoning of the learner was met with the implementation and utilization of case-based learning in the academic programs studied. The participants reported that with case-based learning, the students demonstrated improved critical thinking and clinical reasoning and problem-solving skills. This is consistent with the findings from Hmelo (1998) who demonstrated that students in a problem-based curriculum that utilized CBL were more comprehensive in the problem-solving and utilized more hypothetico-deductive reasoning in their processing of clinical problems than students from a traditional curriculum. Patel, Groen, and Norman (1991) performed a similar study and had similar findings with increased hypothetico-deductive reasoning processes in medical students in a PBL vs. traditional

curriculum. They also described that the students receiving CBL in the PBL curriculum were quicker and more accurate in their reasoning processes. The participants in the present study reported the learners were more efficient and accurate with differential diagnosis with the implementation of CBL in the didactic preparation of the learner. Scaffa and Wooster (2004) described how the implementation of a PBL course utilizing CBL methods in an occupational therapy curriculum increased the participants' scores on the Self-Assessment of Clinical Reflection and Reasoning (SACRR). The learners demonstrated significant gains in the areas of theory utilization, the utilization multiple data sources, hypothesis orientation, and critical appraisal of information. This is similar to the findings of the present study as well in that the learners were described as being more independent in the learning process, they were more engaged in the pursuit of knowledge and understanding, and had developed the tools of inquiry to seek out multiple sources of knowledge and scrutinize the sources to implement true evidence-based practice.

The participants of the study performed by Hayward and Cairns (1998) demonstrated many similar outcomes in the realm of clinical reasoning and problem-solving. These participants described how CBL enhanced their clinical thinking and problem-solving skills as well as deepen the level of their thought processes. The author also described how the participants reported gaining the tools for critical inquiry and, in the words of the author, the ability to "dig for knowledge." Another similarity in the findings was that the participants described the facilitation of the CBL experiences as providing a model for clinical problem-solving as was found in the results of data analysis of the present study.

Enhanced Student Clinical Preparation

The final major finding of the evaluation of the utilization and implementation of case-based learning in the selected physical therapy programs was the ability of CBL to better prepare the students to enter the role of a physical therapy practitioner. The participants described how CBL helped them become more independent in the process of evaluating and treating physical therapy patients. They also described that they felt they were able to improve upon their interpersonal skills including professional communication, interprofessional understanding and interactions, and identification of professional and ethical issues present in patient scenarios. Through this they feel more comfortable and confident in patient interactions as well as their abilities to empathize with and understand the whole patient. Kaufman, Portney, and Jette (1997) reported similar findings from their learners through implementation of a problem-based curriculum that utilized CBL methods. Their learners were rated significantly higher ($p < .05$) on their ability to accept and respond to constructive criticism, accept responsibility for their own learning, and communicate in a professional manner. Richards et al. (1996) found that students from a problem-based curriculum in medicine were ranked significantly higher than their counterparts in a traditional curriculum in all areas of their performance ratings of clinical clerkships rating scale including the ability to perform a patient interview and physical examination ($p = .002$), devise an accurate differential diagnosis ($p = .0005$), and organize and express clinical information ($p = .004$). The study performed by Hayward and Cairns (1998) also reported that CBL increased their learners' preparation for entry into the field of physical therapy. The participants of this study reported a better ability to interact with, teach, and learn from peers, as well as, overall improvements in their

communication skills. These participants also reported gaining a better understanding of the team approach to treatment and interdisciplinary care.

Barriers to Implementation and Utilization of CBL

Even though case-based learning was reported by the participants to be successful in carrying out the objectives in meeting the objectives of its implementation, many barriers to effective implementation and utilization were introduced by the participants including the ideas of buy-in by faculty, students, and administrators, large time requirements to effectively utilize and implement CBL, specific setting characteristics that make it difficult implement, and individual personality learning styles and abilities differences. Table 1.2 provided a list of common barriers to the implementation and utilization of CBL in multiple disciplines (Hung, Bailey, & Jonassen, 2003; Lee, 1999; Solomon & Finch, 1998; Tarnvik, 2007; Thompson & Williams, 1985; and Yadav et al., 2007). Discussions regarding all of these 14 barriers listed were present in the data collected in the present study. Of the participants studied, the barrier discussed most frequently was time constraints to using cases in teaching. Four of the studies listed in Table 1.2 found time constraints to be a large barrier as well. The most prevalent barrier in the literature presented in the table was difficulty and resistance of the learner to transition to the learning style required by problem-based learning. This was not as prevalent in the experiences of the participants of the present study. This is most likely due to the fact that the present study was looking at case-based learning as opposed to problem-based learning. In differentiating CBL and PBL, the participants of this study as a whole demonstrated a preference for case-based learning over problem-based learning methods. This is consistent with the findings of the study by Srinivasin et al. (2007) who found that the majority of students

and faculty from two medical schools demonstrated a preference of CBL to PBL. Hayward & Cairns (1998) described that only one of the eight participants did not prefer CBL over more traditional methods of instruction. This was found to be due to the participants learning style and preference for more passive and directed learning experiences. This was seen in the present study as a common barrier on both the part of the learner as well as the instructor.

Through applying the Hammond's Goal-Attainment Model for program evaluation, it can ultimately be seen that through the implementation and utilization of case-based learning in the physical therapy programs studied, the intended outcomes and objectives of the learners were effectively met in all of the participating programs. It can thus be surmised that case-based learning is not only an adequate tool for the professional education of physical therapy students, but also that it may be one of the most effective instructional methodologies utilized in preparing physical therapy students for their future professional roles. The next sections discuss the major themes that emerged from the data that address the attributes of case-based learning design and use that were found to be effective in producing these positive outcomes in the participating programs' learners.

Discussion of Themes and Relationships

Four main themes emerged regarding methods and development of the case-based learning experience that were consistent with effective utilization and implementation in meeting the intended objectives of case-based learning. These included creating a real and authentic case-based learning experience, creating a safe learning environment, finding the exact balance between too little and too much information and facilitation provided, and building confidence through case-based learning. Much literature has been produced

discussing the design of effective cases to be used in case-based and problem-based learning experiences. One article by Dolmans (1997), introduced seven principles for effective case design. These principles are as follows:

- (1) The contents of a case should adapt well to students' prior knowledge.
- (2) A case should contain several cues that stimulate students to elaborate.
- (3) Preferably present a case in a context that is relevant to the future profession.
- (4) Present relevant basic sciences concepts in the context of a clinical problem to encourage integration of knowledge.
- (5) A case should stimulate self-directed learning by encouraging students to generate learning issues and conduct literature searches.
- (6) A case should enhance students' interest in the subject-matter, by sustaining discussion about possible solutions and facilitating students to explore alternatives.
- (7) A case should match one or more of the faculty objectives. (p.186)

Kim et al. (2006) performed a systematic literature review of 100 articles dealing with case design in case-based or problem-based learning experiences. Through this qualitative meta-analysis, she identified five key attributes of effective cases including that the cases be relevant, realistic, challenging, and instructional. All of the elements discussed in both of these previous articles can be found throughout the data of the present study. The following sections describe the themes that emerged from this data regarding not only case design, but the full

implementation and utilization of case-based learning experiences within physical therapy curricula.

Making It Real

The first main theme that emerged in the data was the concept of making the case-based learning experience an authentic experience for the learner. This idea of realism was seen in both Dolmans' (1997) principle number four and Kim's (2006) key attribute number two. Through analysis of the data, multiple methods were identified through which one can design a case in a case-based learning experience to make it more realistic and authentic for the learner including the use of actual patient interaction, role playing, audio-visual media, and highly contextual and descriptive cases. A concept map may be found in Figure 4.2 which demonstrates all the aspects identified that go into creating a realistic case-based learning experience and how this leads to improved patient interaction by the students. By effectively creating this realistic experience, the learner becomes more interested and motivated in the learning experience, is given the opportunity to experience empathy, can gain a better understanding of empathy, and possibly have an emotional response in connection to the case, which ultimately leads to increased retention and learning. All of these outcomes work together to provide an opportunity for the student to become more effective at treating the whole patient. Kim (2006) found similar findings in making the CBL experience more realistic. She described five attributes of cases that enhance authenticity including the use of authentic materials and case information when available (such as MRI or x-ray images), including psychosocial dynamics as well as clinical ambiguities that could and will be seen in real life practice, incorporating psychomotor tasks and human interaction when able, incorporating

distracters and non-essential information into case, and utilizing gradual disclosure of case information. All of these attributes can be seen in the data collected in the present study and went into the development of the concept map in Figure 4.2.

Making It Safe

The second main theme that emerged through data analysis was the idea of providing a safe learning environment in case-based learning experiences. There was duplicity in the meaning of this safe environment that could be seen. First, the participants described how this safe environment from a technical standpoint of professional liability. Without the presence of an actual patient the student was not at risk for injuring the patient or doing something incorrect that could cause the patient harm. In this environment, the student was able to practice psychomotor skills, such as patient transfers and handling skills, on classmates or faculty who were role-playing the part of the patient. This removed the high stakes liability issues that they may have experienced if they were learning these for the first time on actual patients. The other main aspect of a safe environment that was described dealt with an environment that was supportive and not destructive to the learner in the learning moment. Many participants described the importance of allowing the student time to think without rushing them, letting the student make educated guesses without fear of being berated by faculty or peers.

Many strategies were described in the data that assist the facilitator in creating such a safe learning environment. The concept map in Figure 4.3 shows how the case-based learning attributes discussed in the data collected lead to creation of a safe learning environment, and how this enhances the learning experience for the student. These CBL experience attributes

include the diminished reliance upon extrinsic motivators such as grades and liability, encouraging student interaction, and having a supportive or coaching facilitation style. It can further be seen that a safe learning environment provides a safety net for the learner so they can explore knowledge and try multiple strategies and techniques within physical therapy practice without the fear of making a mistake or putting a patient at risk. It also increases student interaction so they may be more open to the learning experience and participating in the overall learning process. The study performed by Hayward & Cairns (1998) had similar findings which further suggests the importance that this safe learning environment has on the case-based learning experiences for physical therapy students.

Balancing Acts

Another theme that was found throughout the interviews with administrators, faculty members, and students was the idea of finding the perfect balance between adequate or excessive case information and facilitation provided. It was found that in order to create an impactful learning environment, one must find a proper balance between providing too much and too little facilitation and case information based on the specific level of the learner. The case information provided should act as intricate puzzle pieces must be assembled by the student or physical therapy clinician to arrive at a differential diagnosis and execute a plan of action. Furthering the analogy of a puzzle, it would be no challenge if puzzle pieces were presented in the exact order that they are to then be connected. However, it would be impossible to complete the puzzle if not all of the pieces were given or if the image of what the puzzle should be were not presented to the person completing the puzzle. In teaching

someone to complete the puzzle, it is more meaningful for them to learn the pattern for completing the puzzle rather than be handed a puzzle piece and told where to put it.

A differentiation needs to be made here between *case* information and *contextual* information with regards to the information provided. When referring to case information, this is that information that is vital to understanding the complexities of the case and coming up with a differential diagnosis as described above. Contextual information includes all of the descriptions of the patients and their lives, which are provided in rich detail to increase the authenticity of the learning experience as described before. This finding contradicts the descriptions of the amount of case provided in the taxonomy of problem-based learning methods presented by Barrows (1986). He described that as the experience becomes more problem-based that the case provided becomes physically shorter to where just a problem or vignette is provided. The participants in the present study described that as the learners progressed and became more independent towards the end of the curriculum, the cases increased in size and complexity. In these cases, more contextual information was provided and the problems were larger and more complex to solve while the same amount or less case information was provided. In differentiating between this case information and contextual information and applying it to the Barrow's taxonomy, it may be seen that as the methods become more problem-based in essence, they provide less case information but are not necessarily smaller in size.

Figure 4.4 lists the negative consequences of these excesses and paucities that were described by the participants in the present study. It was found that with too much information provided that the students didn't feel as though they had anything to *do* in the

case, and they felt that they were being taught to rather than given a problem to solve. On the other hand, when students felt that they weren't given enough information, they felt lost in the learning experience without any real guidance as to what they were supposed to be learning, on what they were to be focusing, or knowledge of what they were to be doing with the patient. Similar findings were discovered regarding the level of facilitation provided during the learning experience. If the facilitator was too involved, the students felt as though the facilitator may be looking for one right answer or one right way of doing things. Less independent students often became too reliant upon the facilitator with this level of facilitation and risked failure to attain the true level of independence needed to enter clinical practice. Students described too little facilitation as being overly ambiguous. In these experiences, they described feeling as though they never learned what was right or wrong in the case scenario or in their thought processes.

These findings were mirrored in the study by Hayward & Cairns (1998) who described the preference for these levels of information and facilitation as being closely tied to the personal learning and teaching styles of the individuals involved. They did recognize the importance of learner independence and discussed ways of moving the learner to feel more comfortable with less information and facilitation. The participants from the study by Hayward & Cairns (1998) described their frustration with the overwhelmed feeling of too much information and confused emotions of not having enough information to get started. It was interesting to see the similarity between the transcript excerpts from the student participants of that study and the present study with regards to this balancing act. Dolmans (1997) described that the case should give enough information to influence the learner to ask

questions as well as further expound on the information that is provided. Kim et al. (2006) discussed many of these aspects of balancing information and facilitation as well. She described that the case needed to be very complex in order to make the experience both engaging and challenging to the learner. Finding this balance between excessive and insufficient facilitation and presentation of case information is difficult and changes for each learning experience based on the level of the learner, but this balance must be found in order to provide an impactful learning environment and experience for the learner.

Confidence Building

The final theme found through data analysis of the interview transcriptions was the concept of developing the case-based learning experience in such a way as to build the confidence of the learner in assuming their role as physical therapy practitioner. This theme incorporates all three of the previous themes discussed and is depicted in the concept map found in Figure 4.5. The participants in the study described how struggling through case problems and having success in figuring these problems out helped them to build confidence for the next time they were presented with a similar problem. In order for them to feel open enough to engage in this learning experience, it is important for the student to feel as though there were minimal negative consequences for making mistakes. As described in the section above recording balancing acts, the student will not experience success if there is not real problem for them to solve. Thus, if they are given too much case information, they will not feel as though they *solved* the case and thus won't feel success and will not build confidence. The same may be true for too little information as well as too much or too little facilitation as described in the previous section. If the student does not perceive that the case is plausible or

real, they will not be as interested or involved mentally in the process. They also will not retain the information learned through the learning experience as well. Thus, all of these aspects are important in helping the student gain confidence in assuming the role as physical therapy clinician. The participants in the study by Hayward & Cairns (1998) reported this same feeling of increased confidence and comfort level over time with accumulated successes. This confidence was seen as one of, if not the, most important aspects of the preparation of physical therapy students to enter their clinical rotations and enter the profession of physical therapy.

Limitations of the Study

There were many limitations of the present study that dealt with the three main aspects of sampling procedures, data collection, and data analysis. As discussed previously in this paper, many steps were taken that were aimed at increasing the reliability and validity of the findings of this study. However, there were many aspects of the research design and practical application presented these limitations that remain. With regard to sampling procedures, purposeful convenience sampling was used to identify academic programs that would participate in the study. These sampling techniques are based on the findings of a survey performed by the researcher by which individuals reported their academic programs' levels of utilization and implementation of CBL, as well as their programs' interest in participating in the study. One limitation of the study is the potential for a significant amount of bias in the selection of these academic programs based on geographic location, willingness to participate, and the self-reported levels of implementation and utilization of case-based learning methods. Another limitation is that only eight physical therapy programs out of a total of 212 academic programs across the United States were selected for participation. However, this limitation

probably has minimal effect on the findings of the study due to the fact that there was evidence of data saturation after the sixth program studied. There were no new codes or categories that emerged through the data collection of the participants at the last two physical therapy programs studied. They would then be assumed that minimal new knowledge and understanding would be attained by performing further data collection from any of the other 204 academic programs. The last limitation dealing with sampling procedures was the fact that these specific sampling of participants at each academic program was handled through the original contact person of that program rather than by the primary researcher. This introduced the possibility of a large amount of bias in the selection process utilized by these individuals. For example, they may have selected individuals that they believed held positive regard for case-based learning rather than those individuals that they believed did not.

A second area of limitations of the present study deals with the methods of data collection utilized by the researcher. As discussed previously, an emerging questions design was used in the interview process in order to allow the participant's more freedom to discuss issues that were important to them regarding their use of case-based learning in the classroom. Since the researcher did not adhere strictly to a set list of questions, discussions in each of the 28 interviews performed were unique. This decreased the consistency of data collection between individual participants and participating programs. For instance, in a few of the interviews more time was spent discussing case-based learning and its specific use in evaluating students, which meant that less time was spent discussing other aspects of case-based learning. This was recognized in the fact that discussions regarding barriers to utilization and implementation of case-based learning were not discussed in a total of seven interviews.

Through the triangulation of data sources, this limitation was minimized. Using the example of discussions of barriers, even though the topic was not raised in seven of the interviews, it was discussed in at least one or more interviews in each of the eight participating programs.

The other limitation regarding data collection was in the use of classroom observations as a data source. Logistically the researcher was unable to schedule classroom observations at 75% of those programs studied. The classroom observations were to be of actual classes or small-group collaborative learning experiences where case-based learning methods were being utilized. It was very difficult to schedule one-on-one interviews with administrators and faculty members and focus group interviews with students all on the same day, let alone to fortuitously have that day scheduled at the same time as an actual case-based learning experience with that set of learners. This did occur at two of the academic programs studied and I was able to perform one classroom observation and one small-group discussion. However, these were the last two academic programs studied so the findings from the classroom observations were not able to inform the majority of the data collection. One of these classroom observations actually occurred at the last program studied after completing all of the interviews at that program. There were some benefits from performing the classroom observations, however, these did not serve the intended purpose of assisting me in further formulating questions regarding the case-based learning experience at the different academic programs.

The last major limitation of this study involved analysis of the data and the researcher's subjectivity. Since the primary researcher performed all of the data collection and data analysis, personal bias may have influenced the selection of questions asked, the codes

identified, and the relationships and conclusions found through the data analysis process. Throughout the data collection and data analysis processes, I paid special attention to this potential bias and took numerous steps to diminish its effect on the overall outcomes of the study. By triangulating multiple data sources, studying a large number of participants and academic programs, and maintaining a field journal chronicling the data analysis process, the effect of researcher subjectivity was minimized as much as possible in carrying out this qualitative evaluation research study. Although many limitations did exist in the design and execution of this research project, much may be gained from the overall findings, themes, and relationships identified as well as the major implications drawn.

Future Research Directions

There are many areas and possibilities for future research that can be identified at the conclusion of this research project. Since the primary researcher is an educational practitioner in the field of physical therapy, only physical therapy academic programs were evaluated in this study. As described before, case-based learning is utilized in many health professions and similar data collection and analysis procedures in academic programs across differing health sciences professions would be beneficial. It would also be interesting to broaden the scope of participants within the field of physical therapy by identifying individuals or programs that are minimally or are not currently utilizing case-based learning in their curricula. If possible, a longitudinal study which would follow some of the student participants of the present study into the first few years of their physical therapy practice may be very informative. This would focus on how these individuals perceive the effects of case-based learning under actual clinical performance asked physical therapists. Finally, further research may be performed on the data

that was already collected during this research project. The researcher accumulated over 36 hours of audio that contains a large amount of rich data that may be used to answer multiple research questions beyond the scope initially posed in the present study.

Conclusions

The purpose of this study was to evaluate the utilization, implementation, and perceived effectiveness of case-based learning in selected physical therapy schools across the United States. Through the analysis of the qualitative data gleaned from the participants, case-based learning was found to be a very effective instructional methodology in these academic programs as described by administrators, faculty, and students alike. Specifically, case-based learning is able to effectively enhance students' learning, problem solving skills, clinical preparedness, and confidence levels. Multiple barriers exist that may limit the effectiveness of the implementation and utilization of case-based learning including stakeholder buy-in, time and cost requirements, an individual knowledge and skill with case-based learning techniques. Multiple factors do exist that may positively influence the effectiveness of the implementation and utilization of case-based learning including techniques that make the learning experience safe, real, impactful, and empowering. In conclusion, if performed correctly, case-based learning is a strong instructional tool in the professional preparation of physical therapist.

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Appendix A. Program Survey of CBL Implementation and Utilization



Win the book "Who Learns What from Cases and How?" by completing this survey and turning it in to Kirk Nelson at the APTA Educational Leadership Conference in Minneapolis, MN. Drawings will be held on Saturday. For more information contact Kirk Nelson at 504-952-0949.



Utilization of Case Method Teaching in Physical Therapy Curricula

This survey represents a first effort in my proposed study regarding the utilization of the case method as an instructional methodology in physical therapy educational programs. Please answer these few questions regarding your physical therapy educational program. Your completion of this survey is greatly appreciated and will serve as your informed consent.

1. Which of the following best describes your curricular model as reported on the Annual Accreditation Report for CAPTE? (Circle the answer) Please indicate if you do not know here: _____

Traditional	Systems-based	Problem-based	Case-based
Lifespan-based	Guide-based	Modified Problem-based	Hybrid

2. How does your program utilize case studies in teaching? For the following statements, rate your program's use of case methodology using the following scale:

0 = Never 1 = Rarely 2 = Often 3 = Almost always

- a. _____ In lectures where the instructor uses cases to provide certain examples.
 - b. _____ As an adjunct to lectures or class discussions where students work through aspects of a case either independently or in small groups.
 - c. _____ Used independently as the primary means of delivering content.
 - d. _____ Used in individual classes without much crossover between classes.
 - e. _____ Used in two or more classes to integrate concepts from multiple courses.
 - f. _____ Used throughout the curriculum to integrate all courses of the curriculum.
 - g. _____ Used as an interdisciplinary tool at a school-wide level to integrate content with other disciplines (other allied health professions, nursing, medicine, etc.)
3. If chosen, do you think your program would be willing to participate in a qualitative study investigating the use of case method teaching? _____
4. Would you be interested in participating as a data collector for this project by performing observations and interviews at physical therapy schools near your home? _____

School/Facility Name: _____ Position: _____

Name: _____ Contact Numbers: _____

In addition to the information provided above, I would appreciate a brief narrative that would describe any additional information that you would like to share about the use of case based methodology at your school. This narrative can be placed on the back of this survey.

Thank you for taking the time to fill out this survey. Your input is very valuable to this study.

Appendix B. IRB Approval Documents

**EXPEDITED APPROVAL
LOUISIANA STATE UNIVERSITY HEALTH SCIENCES CENTER
(Assurance Number FWA00002762)
IRB Registration Number 00000177 expires October 18, 2010**

FROM: LSUHSC-NO Institutional Review Board
TO: Joseph Moerschbaecher, Ph.D.
Vice Chancellor for Academic Affairs
RE: IRB Application By: **T. Kirk Nelson, MPT**
Department of Physical Therapy

Entitled: IRB #7404: Case-based Learning (CBL) in Selected Physical Therapy Curricula and its Perceived Effectiveness

This is to document review and approval of the above-referenced research protocol. In the judgment of this Board, the procedures delineated in said application conform to the pertinent DDHS and FDA rules and regulations regarding use of human subjects. This procedure is authorized by 45CFR46.110 and 21CFR56.110 as published in the Federal Register November 9, 1998. Records regarding action of the Board, referable to said project, are on file in the Office of the Chairman. This study is expedited under 46.110 category #6 & 7 of 45CFR Part 46.

THE INVESTIGATOR agrees to report to the Committee any emergent problems, serious adverse reactions, or procedural changes that may affect the status of the investigation, and that no such change will be made without Board Approval, except where necessary to eliminate apparent immediate hazards. The investigator also agrees to periodic review of this project by the Board at intervals appropriate to the degree of risk to assure that the new project is being conducted in compliance with the Board's understanding and recommendation, and this interval will not exceed one year.

- PLEASE NOTE:**
1. Any advertisement to recruit subjects for this study must be approved by the IRB prior to posting, publication and/or distribution.
 2. Other institutional approvals may be required before the study can be initiated.
 3. Written notification (at the time this study is completed/ canceled) must be sent to the Office of the Chairman.

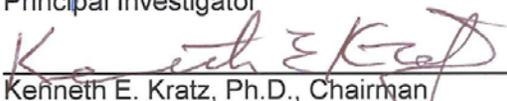
Approval Period:

1/14/10 to 1/13/11



Principal Investigator

DATE: 1/15/10



Kenneth E. Kratz, Ph.D., Chairman

DATE: 1/14/10

**University Committee for the Protection
of Human Subjects in Research
University of New Orleans**

Campus Correspondence

Principal Investigator: Yvelyn Germain-McCarthy
Co-Investigator: T. Kirk Nelson
Date: February 23, 2010
Protocol Title: "Case-based Learning (CBL) in Selected Physical Therapy Curricula and Its Perceived Effectiveness"
IRB#: 07Mar10

The IRB has deemed that the research and procedures are compliant with the University of New Orleans and federal guidelines. The above referenced human subjects protocol has been reviewed and approved using expedited procedures (under 45 CFR 46.116(a) category (7)).

Approval is only valid for one year from the approval date. Any changes to the procedures or protocols must be reviewed and approved by the IRB prior to implementation. Use the IRB number listed on this letter in all future correspondence regarding this proposal.

If an adverse, unforeseen event occurs (e.g., physical, social, or emotional harm), you are required to inform the IRB as soon as possible after the event.

Best wishes on your project!

Sincerely,

Robert D. Laird, Ph.D., Chair
UNO Committee for the Protection of Human Subjects in Research

Appendix D. Letter to Academic Program

Program Director
Department of Physical Therapy

Dear (Program Director)

My name is Kirk Nelson and I am on faculty at LSUHSC New Orleans Department of Physical Therapy. I am writing you in regards to a survey that you completed in October, 2007, at the Educational Leadership Conference of the Education Section of the APTA. In this survey I gathered information about your program's utilization and implementation of case-based learning in the classroom. I also ascertained your program's possible interest in participating in a qualitative study looking at the utilization, implementation, and perceived effectiveness of case-based learning in physical therapy curricula.

Based on your responses on that survey, I have selected your institution as one of the schools that I would like to research in my study. You had reported in the survey that your institution would possibly be willing to participate in the study at the given time. If you agree, I would set up and conduct a one-day visit consisting of one-hour interviews with you and one or two other faculty members who use cases to teach in their courses. I would also like to perform a focus group interview with five to seven of your students. If possible, I would also like to observe any classroom activities where cases are being used to teach. Each participant will receive \$50.00 compensation for their time with the interview process.

If you are interested in participating, I would like to discuss with you the best time to come and visit your school for these interviews. I will be performing data collection during the month of February, 2010, and would like to find a time that is both convenient for you and a time when all participants would be available.

I do appreciate your time and hope that you take this opportunity to have your efforts and achievements in producing and implementing case-based learning in your curriculum applauded and recognized.

Sincerely,

T. Kirk Nelson, MPT
Instructor – LSUHSC Department of Physical Therapy

Appendix E. Interview Consent Form

LOUISIANA STATE UNIVERSITY HEALTH SCIENCES CENTER
Informed Consent Form

1. Study Title: Case-based Learning (CBL) in Selected Physical Therapy Curricula and Its Perceived Efficacy by Students, Faculty, and Administrators

2. Performance Sites:

Physical Therapy academic programs in California, Florida, Indiana, and Illinois.

3. Investigators:

T. Kirk Nelson, MPT Primary Investigator
[Contact information removed for privacy]

4. Purpose of Study:

The purpose of this study is to evaluate the utilization and implementation of case-based learning in physical therapy schools across the country, as well as to identify indicators of effective implementation of CBL in physical therapy programs and gain a better understanding of the perceived efficacy of this methodology by physical therapy students, faculty, and administrators in these schools.

5. Description of the Study:

Case-based learning (CBL) is commonly used in physical therapy curricula even though not much evidence exists as to the effectiveness of this instructional tool in physical therapy education. Through qualitative evaluation methodology, the researcher will investigate the utilization and implementation of this instructional methodology in physical therapy curriculum, as well as its perceived efficacy by physical therapy students, faculty, and administrators. Data collection will be performed at numerous physical therapy programs across the United States that have been identified as moderate to high implementers of CBL through classroom observations, interviews, and focus group interviews. The data collected will be analyzed and conclusions drawn regarding the utilization, implementation, and perceived effectiveness of CBL in the curricula of these physical therapy programs.

6. Benefits to Subjects:

As a potential benefit, you may have the opportunity to reflect on your own educational beliefs as well as gain a better understanding of your own teaching and learning styles. Academic programs may gain insight into how they are currently utilizing and implementing CBL in their perspective curricula as well as possibly identifying areas for further improvement.

7. Risks to Subject:

Although minimal, there is a potential risk that you may feel obligated to share information with the interviewer that you may perceive to be personal in nature. Any subject matter that you do not feel comfortable sharing does not need to be discussed and you have the right to refuse to answer any or all of the questions asked.

Another potential risk would be the possible loss of confidentiality. The interview sessions will be recorded so that transcriptions will be typed and analyzed using a word processor. These recordings will be done using a digital voice recorder and all audio files and typed transcriptions will be kept on a personal computer with password protection in order to assure the highest level of confidentiality. If the results of the study are published your privacy will be protected and you will not be identified in any way. These recordings and transcripts will be kept in digital form on the principal investigator's computer in a password protected folder for a period of up to three – five years while further data analysis is being performed. Once all data analysis has been performed on the transcripts and recordings, these files will be deleted from the computer.

8. Alternatives to Participation in the Study:

The alternative is not to participate.

9. Subject Removal:

The researcher may stop you from taking part in this study if at any time it is believed to be in your best interest; if you do not follow the study procedures; if the study is stopped.

10. Subject's Right to Refuse to Participate or Withdraw:

Participation is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled, and you may discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. Since participation in the interview process is completely voluntary, you have the choice not to participate as well as the ability to terminate the interview at any time for any reason.

11. Subject's Right to Privacy:

The results of the study may be released to the LSUHSC Department of Physical Therapy. If the results of the study are published the privacy of subjects will be protected and they will not be identified in any way. Your personal information may be disclosed if required by law.

12. Release of Information:

Organizations that may inspect and/or copy your study-related records for quality assurance and data analysis include: the LSUHSC Department of Physical Therapy, the University of New Orleans School of Education Department of Curriculum and Instruction, and the LSUHSC-NO Institutional Review Board. While every effort will be made to maintain your privacy, absolute confidentiality cannot be guaranteed. Records will be kept private to the extent allowed by law.

13. Financial Information:

Participation in this study will not result in any extra charges. You will receive a \$50 stipend for your participation as reimbursement for your time and travel. Your participation in this study and the time that you have volunteered to participate is greatly appreciated.

14. Signatures:

The study has been discussed with me and all my questions have been answered. Additional questions regarding the study should be directed to the investigators listed on page 1 of this consent form. If I have questions about subject’s rights, or other concerns, I can contact the Chancellor of the LSU Health Sciences Center New Orleans at (504) 568-4801. I agree with the terms above, acknowledge I have been given a copy of the consent form, and agree to participate in this study. I have not waived any of my legal rights by signing this consent form.

Signature of Subject

Date

Signature of Principal Investigator

Date

Consent Administered by

Date

Appendix F. Participant Demographic Form

Case-based Learning (CBL) in Selected Physical Therapy Curricula and Its Perceived Effectiveness by Students, Faculty, and Administrators

Participant Demographic Form

Name: _____ SS: _____

(needed for payment of stipend)

Mailing Address: (For mailing the compensation payment of \$50)

Age: _____ Gender: _____ Title: _____



STUDENT:

Level of Student (Circle): DPT I DPT II DPT III

Prior Experience with case-based learning (before entering PT school):

No experience Minimal experience Large amount of experience



FACULTY:

Years with Current Program: _____

Total years of teaching experience: _____

Highest Degree Earned: DPT tDPT PhD DHS MPT MS other: _____

Area of Specialty: _____

Prior Experience with case-based learning (before entering teaching in this program):

No experience Minimal experience Large amount of experience

Appendix G. One-On-One Interview Moderator Guide

Faculty Administrator Interview Moderator Guide

Welcome

- Thank you for coming given your busy schedule ...
- I am Kirk Nelson and I am a student at the University of New Orleans ...
- I have asked you all here to gain a better insight into the utilization and effectiveness of case-based teaching and learning in your physical therapy program. There are no right or wrong answers. I am very interested in what you all think and feel.

Purpose

- The purpose of my inquiry is to better understand how you use cases in your classrooms as well as what you think are the benefits and drawbacks to case based learning for you individually.
The findings of this study will be used for my dissertation at UNO. When I write up the findings of this study I will de-identify any information that you give so that your confidentiality in the reporting of my findings may be maintained. For instance, I will not be using your real names nor any names that you may mention locally (classmates, instructors, etc.). I can assure you that *I* will not discuss anything that is stated in this interview outside of here.
- For the interest of time, I may break in from time to time to help focus or guide the discussion, but I will try to do this as little as possible.

Getting Started Questions

- To begin with, I just wanted to clarify by what I mean by the term “case-based teaching or learning”. But first I want to hear what you think I mean by that. What do you think about when I say case-based teaching and learning?
- What do you think constitutes a case?
- In your curriculum, are there any courses that are completely or mostly utilizing case-based learning? Describe these classes for me.
- Are cases used heavily in other classes as well? Which classes? Are instructors required to use cases, strongly advised, or left to make the decision themselves?
- How are the cases utilized – as primary means of giving information or as a means of reinforcing information? Describe.

- How much facilitation do you usually get while in a CBL experience?
- Who facilitates?
- Do you think cases help students learn the material better? How/Why?
- What is the difference between how you prepare and interact in a CBL experience as compared to traditional lecture or classroom discussion?
- What are the major benefits of CBL as you see it?
- Limitations, drawbacks, or barriers to use?
- Does CBL work better than other methods – how do you know?

Appendix H. Focus Group Interview Moderator Guide

Focus Group Interview Moderator Guide

Welcome

- Thank you for coming given your busy schedule ...
- I am Kirk Nelson and I am a student at the University of New Orleans ...
- I have asked you all here to gain a better insight into the utilization and effectiveness of case-based teaching and learning in your physical therapy program. There are no right or wrong answers. I am very interested in what you all think and feel.

Purpose

- The purpose of my inquiry is to better understand how you use cases in your classrooms as well as what you think are the benefits and drawbacks to case based learning for you individually.

Ground Rules

- Before we get started I do want to set a few ground rules for the discussion. First, as I stated before, I am interested in hearing what each and every one of you think and feel. I do ask that you respect each other's comments and not use any negative or derogatory comments towards each other.
- Secondly, due to the nature of the focus group, I cannot guarantee confidentiality. When I write up my report I will not be using your real names nor any names that you may mention locally (classmates, instructors, etc.). I can assure you that *I* will not discuss anything that is stated in this interview outside of here except for the purposes of my research. I cannot assure that the other members of the group will do the same. What I do ask is that you respect each others' confidentiality and not talk about anything discussed here outside of this group.
- There is no particular order in which to speak, but I do ask that you only speak one at a time and try not to interrupt anyone else while they are talking. I will be tape recording this session as I mentioned earlier and it is very difficult to discern what is being said if more than one person is talking at the same time.
- For the interest of time, I may break in from time to time to help focus or guide the discussion, but I will try to do this as little as possible. Of course, my wife and students would probably tell you that I have difficulty with limiting that.

Getting Started

- To begin with, I just wanted to clarify by what I mean by the term "case-based teaching or learning". But first I want to hear what you think I mean by that. What do you think about when I say case-based teaching and learning?
- What do you think constitutes a case?

Questions

- Describe for me how your program is using cases to teach in their program?

- Are cases used heavily in other classes as well? Which classes?
- How are the cases utilized – as primary means of giving information or as a means of reinforcing information?
- How much facilitation do you usually get while in a CBL experience?
- Who facilitates?
- Do you think cases help you learn the material better? How/Why?
- What is the difference between how you prepare and interact in a CBL experience as compared to traditional lecture or classroom discussion?
- Does CBL work better than other methods – how do you know?

Appendix I. Full List of Codes and Categories

Research Question	Category	Sub-Category	Code	P1			P2			P3			P4			P5				P6					P7				P8				
				A	F	S	A	F1	F2	S	A	F	S	A	F	S	A1	A2	F2	S	A	F1	F2	S	O	A	F1	F2	S	A	F	S	O
			Fabricated case										X															X					
			Prefabricated case				X																										
			Match case or cases to demographics, culture, etc.				X																										
			Multiple outcomes or possibilities						X														X										
			CBL Experience structure																														
			Individual CBL Experience	X		X	X					X	X		X	X	X	X								X			X				
			Paired CBL Experience		X																												
			Small Group CBL Experience	X	X	X	X	X	X	X		X	X	X	X	X	X				X	X	X						X	X	X	X	
			Whole Class CBL Experience	X									X	X	X	X					X	X	X						X	X	X		
			Individual -> Small Group -> Whole Class	X						X															X								
			Whole class meeting at end for wrap up	X	X	X				X			X	X		X	X					X			X				X				
			Whole Class -> Small Group -> Individual							X																							
			On-line Asynchronous	X			X						X				X								X				X				
			Case first then lecture			X					X																		X				
			Lecture first then case			X				X	X							X		X													
			Case only					X	X	X		X									X			X								X	

Research Question	Category	Sub-Category	Code	P1			P2				P3			P4			P5				P6					P7				P8						
				A	F	S	A	F1	F2	S	A	F	S	A	F	S	A1	A2	F2	S	A	F1	F2	S	O	A	F1	F2	S	A	F	S	O			
			Student related barriers																																	
			Buy-in from learners	X			X			X									X	X	X							X								
			Information/resource overload		X					X										X																
			Learning styles and beliefs re: education not in line				X	X	X	X						X					X							X								
			High stakes (practicals/grading) increases stress			X														X									X						X	
			Student generation impact on learning style					X																				X								
			Hard to know what to study							X										X							X									
			Too little facilitation - don't know where to start											X						X							X									
			Putting in time and effort but not getting "the answer"																								X								X	
			Content related barriers																																	
			Type of content		X																					X	X									
			Amount of content		X					X																	X					X				
			Time limitations in class		X										X	X			X	X																X

Vita

T. Kirk Nelson was born in Omaha, Nebraska, and grew up in Northwest Louisiana. He attended Centenary College of Louisiana and graduated in May of 1997 with a Bachelors of Science in Applied Sciences. He moved to New Orleans and attended school at Louisiana State University Health Sciences Center in the Department of Physical Therapy. He graduated in August of 2000 and was licensed as a physical therapist in the state of Louisiana. He began practicing physical therapy full-time at the Medical Center of Louisiana-New Orleans in both the Charity and University Campuses. In July, 2002, Kirk took a part-time position as clinical instructor at his Alma matter, LSUHSC-New Orleans Department of Physical Therapy. He served as the department's Academic Coordinator of Clinical Education and taught courses in Clinical Neurology. In September, 2005, Kirk became a full-time faculty member in the Department of Physical Therapy. His responsibilities continued to grow and Kirk became the chair of the department's curriculum committee as well as the chair of the Doctor of Physical Therapy (DPT) task force, which was in charge of developing the curriculum for the school's new DPT program that started in May of 2006. Kirk has also been very active in the LSUHSC's Academy for the Advancement of Educational Scholarship. He received membership as a fellow and has served as the co-chair of the Executive Council of the Academy since 2008. While being on faculty in the Department of Physical Therapy, Kirk has coordinated and taught seventeen different courses as well as taught in more than fifteen other courses and in three different departments. He has also given multiple faculty development courses as well as national conference presentations on teaching. He is the proud father of two wonderful children, Jackson and Abby, and is a devoted husband to his wonderful wife, Kay.