GROUP PROCESS IN THE CONTEXT OF A PROBLEM-BASED LEARNING

CURRICULUM

by

THOMAS L. STEC

(Under the Direction of Libby V. Morris)

ABSTRACT

The purpose of this study was to examine the problem-based learning (PBL) group process of students in a master's level physical therapy PBL curriculum. The research: (a) compared the observed process to a group process widely described in the literature, and (b) examined the relationship of the group process to a set of factors which could potentially affect the group process. This study attempts to answer the following questions: (a) What occurs in the PBL group process and does it reflect the most widely used PBL group process? and (b) How does the context in which a PBL group operates affect the group process?

A case study method was used to answer these questions. Both qualitative and quantitative methodologies were used to evaluate transcriptions of group meetings, interviews, program documents, and questionnaires.

Results indicated that variations from the typical PBL group process were present in the study groups. Variations in the group process were noted in: (a) fact gathering, (b) hypothesis generation, (c) identification of learning issues, and (d) group planning. Both groups functioned in an almost identical manner with the exception of some minor difference in the way tutors carried out their roles as facilitators.

The context appeared to positively affect the study groups. Students were actively engaged in the group process. Over the period of four group meetings both groups successfully addressed the objectives of a problem. Student responses to questionnaires indicated that they believed the group process promoted learning. The researcher attributed the apparent success of the group process to a culture that supports and promotes the group process.

INDEX WORDS: Problem-based Learning, Group Process, Curriculum, Case Study, Physical Therapy, Master's, Professional Education, PBL, Tutor, Facilitator

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CHAPTER 1

INTRODUCTION TO PROBLEM AND RESEARCH

This study examines student group process in a problem-based learning, physical therapy curriculum. Problem-based learning (PBL) is designed to engage students in active learning, as described by Barr and Tagg (1995) in their often cited article, "From Teaching to Learning: A New paradigm for Undergraduate Education." In this article, the authors capture the essence of numerous reports and commissions since the 1980s that urged educators to move from lecture-based, instructor-centered education to active, student-centered instruction.

Group work is one form of active learning, and the student group is the functional unit of problem-based learning. Thus, the ability of a PBL curriculum to engage students in active learning and to achieve desired student learning outcomes is closely related to how student groups function in the curriculum. Using a case study approach, this study will examine in detail the group process used in a long-standing PBL physical therapy program. This chapter begins with an introduction to problem-based learning and describes the central role of the group in this type of educational program. This information provides the backdrop for the research questions and an overview of the research design.

Origins of Problem-based Learning

Problem-based learning developed in response to calls for educational reform. Critics blamed traditional education for producing students who were not learning what they needed to know, and if they did, they could not apply what they had learned. Criticism came from within and outside education, from educational associations, faculty, and consumers. Higher education

associations encouraged educators to decrease dependence on lecture. Educational psychologists called for more active student involvement in learning activities. Barr and Tagg (1995) summarized the situation by saying that they believed the education problem to be so serious that a paradigm shift from teaching to learning was needed.

PBL is based on active learning and is often associated with the educational theory of constructivism. Constructivism is rooted in the work of theorists like John Dewey (1956), Jean Piaget (1976), and Jerome Bruner (1966). Constructivism is based on cognitive theory which states that (a) learners construct their own knowledge, (b) new learning is dependent on the students' existing understanding, (c) social interaction plays a critical role in learning, and (d) authentic learning tasks are necessary for developing meaningful learning. The design of PBL provides a framework that accepts and builds on these concepts. Although these concepts may be appropriate for all levels of education, PBL was originally and continues to be associated with professional education.

Problem-based learning has been used in medical education since 1969, originating at McMaster University in Hamilton, Canada. Since that time PBL has become widely used. According to Barrows (2000) by 1991 over ninety medical schools in the United Sates were considering some form of PBL. In addition to medicine, many other professional fields have adopted PBL. Bound and Felleti (1997) provided a comprehensive review of PBL that includes examples of PBL programs from architecture, business, law, engineering, social work, optometry, and nursing.

Curricular Problem-based Learning

Barrows (2000) defines curricular problem-based learning as a way of constructing and teaching courses using problems as the stimulus and focus for student activity. It is not simply the addition of problem-solving activities to an otherwise discipline-centered curriculum, but a way of centering the curriculum that is organized around key problems. Problem-based learning courses start with problems rather than with the exposition of disciplinary knowledge. Students move toward the acquisition of knowledge and skills through a staged sequence of problems presented in context with associated learning materials and support from faculty.

Recent studies (Duch, Groh, & Allen, 1998; Hmelo, 1998; Maudsley & Strivens, 2000; Miflin, Campbell, & Price, 2000; Norman & Schmidt, 1992; Vernon & Blake, 1993) describe PBL as having the following common components: (a) it is student centered, (b) teachers function as facilitators, and (c) problems serve as the initial stimulus and framework for learning. This design is meant to bring about outcomes such as the development of a systematic approach to problem solving, development of self-directed learning, the integration of disciplines, deep learning, critical thinking and the development of life-long learning skills.

Problem-based learning is student centered. Students are expected to take responsibility for their learning, and faculty are viewed as facilitators. It is most often associated with constructivism, which some (Appelfield, Huber, & Moallem, 2001; Davis, Kvern, Donen, Andrews, & Nixon, 2000; Perkins, 1999) associate with the work of theorists like John Dewey, Jean Piaget, Lev Vygotsky, and James Bruner. Appelfield et al (2001) define constructivism as

. . . an epistemological view of knowledge acquisition emphasizing knowledge construction rather than knowledge transmission and the recording of information

conveyed by others. The role of the learner is conceived as one of building and transforming knowledge. (p. 37)

PBL students work in groups, often called tutor groups, in conjunction with faculty who function as facilitators of the process. Students move through the curriculum problem by problem (see Appendix A for an example of a problem). Successful resolution of problems requires information from different disciplines. This mixture of content from different disciplines contributes to the complexity of the problems. In a health care curriculum, such as physical therapy, the product may be a detailed treatment plan with justification based on the patient's case. Such a problem requires the students to explore content from many disciplines such as anatomy, pathology, physics, chemistry, clinical test and measures, psychology, and so on.

Problem-based Learning Groups

The problem-based learning group, also called a tutor group, is the functional unit of PBL and is essential to the overall functioning of a PBL curriculum. According to Barrow, Kelson, Myers, and Feltovich (1998) all problems are initiated in the group and students work in groups for the length of the program. Students are expected to be responsible members of the group, and they must rely on each other to share information and workload in the resolution of problems. The typical PBL group process, the series of actions that occur during the meetings, is characterized by (a) participation of a facilitator who is often called a tutor, (b) participation of six to eight students, (c) problem solving which promotes brainstorming or hypothesis generation, (d) learning which includes time for both individual and group learning, (e) an

exchange of ideas using the Socratic method, (f) identification of learning issues, (g) a gathering of facts about the problem during the meeting, and (g) planning.

Many believe that all PBL groups, regardless of the curriculum, have a similar process or structure that is meant to promote a particular array of group interactions leading to characteristic PBL group function. This is a reasonable belief based on program self-reports about their group process, and the fact that many PBL programs have adopted a curricular model that incorporates the same group process. However, there is very little in the literature that examines whether PBL groups follow their program's intended group process. The researcher's experience has been that the actual process within a single course can vary dramatically between groups and that it often does not match the program's intended group process. This implies that a standard PBL group process may not be actualized in any given curriculum or curricula.

The literature suggests that the PBL group process may be affected by a variety of factors. Such factors can include but are not limited to the following: the educational philosophy of the program, faculty and student training in PBL group process, faculty and student prior experience with PBL groups, faculty and student attitudes toward group work, the perceived role of the student, and the perceived role of the tutor. All of these factors are included in this study and the term "context" is used to refer to their aggregate.

PBL groups are associated with a variety of approaches to problem-based learning. For example, PBL groups may be the functional unit of a single learning activity in a course, a semester-long course, or a curriculum.

Overview of PBL Literature

Most PBL literature is associated with professional education, and the largest part of that literature is related to medical education. Barrows, Smith, Moust, Evensen, Hmelo, Boud, and Feletti are frequent contributors to the literature. Barrows, from Southern Illinois Medical School (SIU), had a large impact both on PBL and on this study

Literature related to undergraduate PBL education is limited but developing. Two of the most notable institutions for information related to undergraduate education are Samford University and the University of Delaware. Both schools provide extensive information about their programs and PBL in general via websites, continuing education, and printed materials.

Origins of This Study

This study originated from the researcher's experience as a faculty member of a master's level physical therapy program in a problem-based learning (PBL) curriculum. The researcher was involved in the program's transition from a traditional curriculum to a PBL curriculum. This experience included both the development and the implementation of the program. During implementation the researcher functioned as an instructor and a PBL group facilitator, or tutor, which led to the researcher's interest in the PBL group process.

During the first semester of the new curriculum the faculty used a variety of informal methods for monitoring the curricular transition. One source was our impressions of the student groups. Because the group is considered the functional unit of PBL (Albanese, 2000), monitoring the groups proved to be valuable in developing an overall impression of the status of the new curriculum. It became apparent that there were differences in the group process between groups and differences between the program's intended group process and actual group process.

These differences had negative effects on the groups, the courses, and the curriculum. These events in part led to this study.

The focus of this study is the PBL group. This study will examine the group process of two groups of students in a problem-based physical therapy curriculum. The intent is to determine (a) how closely the groups follow their program's intended group process, (b) the similarities and differences between the program's group process and the most widely used and documented PBL group process, and (c) what affects the group process of the study groups.

<div align="center">Purpose of Study</div>

The purpose of this study is to examine the PBL group process of experienced students in a Master's level PBL physical therapy curriculum. The research compared the observed process to the group process widely described in the literature and to the program's intended group process. This study attempts to answer the following questions. What happens in the PBL group process and does it reflect the most widely used PBL group process? How does the context in which a PBL group operates affect group process?

<div align="center">Research Design</div>

This study uses a case study design involving observations, interviews, and questionnaires. Yin (1993) stated that " . . . the major rationale for using this (case study) is when your investigation must cover both a particular phenomenon and context in which the phenomenon is occurring" (p. 31). This type of situation often arises in educational research. It is evident in this study where the phenomenon is the group process and the context is the variables believed to affect the group process. Yin (1993) also stated that the case study may be defined as "An empirical inquiry in which the number of variables exceeds the number of data

points" (p. 32). Because of the limited availability of physical therapy schools that offer a PBL

curriculum and the budget constraints of this study, the sample size of this study was small, thus

resulting in a small number of data points. The researcher has also chosen a case study method

based on the focus on a specific population, PBL groups. Several authors (Borg & Gall, 1989;

Merriam, 1998; Van Dalen, 1962) described a case study as an appropriate research method

when a phenomenon, subject, or population is the focus of the study.

I used both qualitative and quantitative approaches. A qualitative approach was used to

examine a specific population, PBL groups. Transcripts from group meetings were analyzed to

determine how the groups operated. Quantitative information about the groups was used to

establish characteristics of the context. This included information about the study site, the study

participants, and data collected from students and tutor questionnaires.

Site Selection

This study examines a master's level physical therapy curriculum. Information from the

American Physical Therapy Association (APTA) indicates that currently there are 4 out of 213

physical therapy programs in the United States that are considered curricular PBL programs.

One of these programs agreed to be the site for this study. The researcher's home program was

not used. The site selected will not be named to protect the identity of the program and the

subjects. The program's educational philosophy was consistent with their use of the PBL

curriculum. The study site also uses the PBL group process throughout the entire curriculum and

problems are used to initiate student learning. The group process of the study program was very

similar to the PBL group process described by Barrows (1998) (see Appendix B for a detailed

example of group structure). The program accepts 11 to 15 students per year and the length of

the program is eighteen months. This study sampled an entire class consisting of eleven students.

Two groups in the same PBL physical therapy program were included in the study for the purpose of replication. The researcher did not interfere with the assignment of tutors or students to groups. All groups were composed of students who had at least one semester of experience functioning in a PBL group, and thus were comfortable with the PBL group process but still needed a tutor. Both groups worked on problems that the faculty considered "good problems", based on the problem's repeated usefulness in facilitating desired student outcomes.

Data Collection and Analysis

Transcribed audiotapes of group meetings and questionnaires were used to examine the group process. The transcriptions of group sessions were used to look for group activities that corresponded to the study program's intended group process and Barrows' PBL group process. Transcriptions of group meetings were broken down into paragraph and sentence sized segments which were then sorted into categories that represented the group process.

Questionnaires were used to collect student and tutor opinions about the group process and to examine student learning. Students filled out questionnaires related to the group process and learning immediately after each group meeting. The questionnaires, discussed in Chapter 3, of tutor and student group satisfaction were assessed by compiling the frequency of each response within and between groups. The student learning questionnaires were analyzed using the same technique used with the transcripts, but the information was sorted into categories that represented student learning.

A combination of questionnaires, interviews, and written information provided by the director of the program were used to define the context surrounding the PBL group. Components included in the context were tutor training, tutor expertise, goals of the curriculum, and student and tutor experience with the PBL group process. Descriptive statistics were used to calculate the frequency of responses for each questionnaire item. Information obtained from an interview with the director of the study program was synthesized and formulated into a written summary of the program's educational philosophy. This information was then compared to data collected about the group process.

Significance of the Study

The result of this study are pertinent to current and future PBL courses and curricula. Because group process is a critical component of curricular PBL, a better understanding of the group process will lead to an increased understanding of the effect of the group process on the overall curricular process and vice versa. Also, this study provides a means for examining the group process which is essential to all other studies related to student groups and PBL. The ability to examine the group is not only pertinent to those involved PBL but to all educational environments that use student groups.

This study is significantly related to the recommended educational reforms addressed by PBL. Many of the educational outcomes of PBL are associated with the group process and determining the group process is primary to evaluating the educational benefits of the group and the curriculum. For example, the group process is one method of moving education away from lecture based instruction with passive recipients of information to student centered learning where students are active learners.

Because group process is a critical component of curriclular PBL, a better understanding of the PBL group process can lead to an increased understanding of the effect of the group process on the overall curricular process. It also demonstrates the need for determining and describing the exact group process used by each PBL program and that this description should come from an assessment of what actually occurs in the groups. Defining the group process is necessary for any assessment of the group or program outcomes. It also implies that comparing PBL outcomes between and among programs is difficult.

The populations most likely to find the results of this study useful include students, educators, curriculum and course designers, and educational administrators associated with PBL. It will also interest to educators not associated with PBL who are interested in using groups as an instructional method and who are interested in educational reform.

CHAPTER 2

LITERATURE REVIEW OF PROBLEM-BASED LEARNING

This study examines the group process of two groups of students in a problem-based learning (PBL) physical therapy curriculum. To understand the purpose of this study it is essential that the reader understand the relationship of the group to the context of a PBL curriculum. This chapter provides the reader with the information necessary to understand the intent and relevance of this study. This chapter explains the connection of the group process to problem-based learning. This will be accomplished by providing information about current PBL research, the history of PBL, the educational theory related to PBL, an overview of the problem-based learning curricular model, the problem-based learning group process, problem-based learning effectiveness, and problem-based learning group outcomes.

Current Problem-based Learning Literature

Current problem-based learning literature is most often related to professional education in particular medical education. Literature available about undergraduate PBL education is limited but developing. Two of the most notable institutions for information related to undergraduate education are Samford University and the University of Delaware. Both schools provide extensive information about their programs and PBL in general via websites, continuing education, and printed materials. Barbara Duch (2001), a faculty member at the University of Delaware, has co-authored a text titled "The Power of Problem-based Learning: A Practical 'How To' for Teaching Undergraduate Courses in Any Discipline". This text provides information on implementing PBL.

The literature from the medical profession was most helpful for this study because of its availability and because it deals with professional curricular PBL. Howard Barrows, from Southern Illinois Medical School (SIU), has had a large impact on PBL. In addition to several articles that cover a wide range of topics including PBL educational theory, PBL outcomes, and PBL curricular design, he has authored two texts, "The Tutorial Process" (1998) and "Problem-based Learning Applied to Medical Education" (2000). Barrows, who began his career at McMaster University, moved to SIU to develop their PBL program. He also, along with other faculty, Kelson, Myers, and Feltovich, (1998) from SIU, offers continuing education courses on every aspect of PBL. In 1998the researcher attended one of these courses called "Problem Design and Curriculum Development in Problem-based Learning".

Henk Schmidt (1983, 1993, 1994, 2000, 1987, 1996, 1995, 2000, 1990, 2000, 1993) from the University of Maastritch, located in the Netherlands, has also influenced this research. He has contributed to the PBL literature for many years and has written about all aspects of PBL including PBL groups and the effectiveness of PBL. He and Moust (1995) are responsible for developing a model used to describe ". . .the influence of tutor behaviors on student achievement and interest in the context of problem based learning" (p. 704). Their (Schmidt and Moust, 1995) article, "What Makes a Tutor Effective? A Structural-equations Modeling Approach to Learning in Problem-based Curricula" was useful for this research because it provided an example of the context of PBL, and it examined the relationship of the context to the PBL group. Schmidt, Dauphinee, and Patel (1987) are strong advocates of curricular PBL; their opinions are soundly rooted in educational theory and educational research. Schmidt and Norman (2000), in

response to an article written by Colliver (2000), defended the effectiveness of PBL in an article titled "Effectiveness of Problem-based Learning Curricula: Theory, Practice and Paper Darts".

Evenson and Hmelo (2000) edited the text "Problem-based learning: A Research Perspective on Learning Interactions", a collection of studies in the area of medical education that investigates two components of problem-based curricula, the group meeting and self-directed learning. Both areas of this text were pertinent to this study but particularly useful were articles about PBL groups. Hmelo-Silver (2003) also authored a recent article that explores the group process through transcriptions of group meetings. Koschmann's (2000) article "When Is a Problem-based Tutorial Not a Tutorial? Analyzing The Tutor's Role in the Emergence of a Learning Issue", included in Evenson's and Hemelo's (2000) text, examines the PBL group process in detail using transcripts to evaluate group interactions. This is one of the methods used in this study.

David Boud, one of the pioneers of PBL learning in Australia, has also made numerous contributions to PBL literature. He is a professor of adult education and Associate Dean of Research at the University of Technology, Sydney. He has authored several articles about teaching and learning (1990, 1992, 1999a, 1999b, 2000, 2001, 1999, 1991, 2002, 1998) and two PBL texts. His first text "Problem-based Learning in Education for the Professions" was published in 1985. This text was the result of the first meeting of Higher Education Research and Development Society of Australia (HERDSA) held in March 1985. This meeting brought together all those using PBL to share their experiences. He co-authored his second text "The Challenge of Problem-Based Learning" (1997) with Grahame Feletti from the University of New Castle (Australia) who has also written several articles (1980, 1981a, 1981b, 1982, 1983, 1997,

1994, 1983) about higher education and PBL. Both texts provide comprehensive overviews of PBL.

The standard for allied health PBL is McMaster University in Hamilton, Canada. It was not only the leader in PBL medical education but also in allied health PBL education. McMaster University School of Rehabilitation Science established a PBL curricular physical therapy program in 1989. The program chosen for this study modeled their PBL curriculum on McMaster's, and some of the faculty received training in PBL techniques from McMaster University.

<div align="center">History of Problem-based Learning</div>

Problem-based learning has been used in medical education since 1969, originating at McMaster University in Hamilton, Canada. It developed in response to calls for educational reform that came from both inside and outside the academic community. PBL, which uses problems throughout the learning process, seemed to fulfill the requirements for educational reform. By 1991 over ninety medical schools were considering problem-based learning. The potential of problem-based learning as a means of improving education has led to its spread beyond medical education. Examples of other fields that have chosen problem-based learning as an educational method are allied health, architecture, and business. It has also been successfully implemented at different levels of education including primary and secondary schools (Barrows, 2000; Boud & Feletti, 1997).

PBL is designed to bring about outcomes such as the development of a systematic approach to problem solving, development of self-regulated learning, the integration of disciplines, deep learning, critical thinking and the development of life-long learning skills

(Duch et al., 2001; Hmelo, 1998; Maudsley & Strivens, 2000; Miflin et al., 2000; Norman & Schmidt, 1992; Vernon & Blake, 1993). Problem-based learning is characterized as (a) student centered (b) a method in which teachers function as facilitators, and (c) a process in which problems serve as the initial stimulus and framework for learning.

Some of the major forces related to the development of problem-based learning came from perceived problems with education. Barrows (2000) believes that educational problems were the stimuli that lead to considering problem-based learning as an educational model. He (Barrows, 1998) states that "...students are passive; they score poorly on national examinations; they know little of the world around them, and they seem not to care; they appear to have little interest in their future or that of their community or nation" (p. 1). He (Barrows, 1998) summarizes by saying ". . . students do not learn enough, what they learn they do not retain; what they retain they cannot use flexibly" (p. 1).

Lack of student engagement is also identified by Kaufman (2000) who suggests that in many situations students are passive learners. And Schmidt (1983), speaking of general educational principles, stated that ". . . high school students, although they had learned physics and new terms, could not apply what they learned" (p. 11). He found that even higher-level students in law, social geography, planning science, and sociology were unable to apply knowledge. Additionally " . . . traditional education (predominately lecture-based) is criticized for lack of relevance to subjects, not enough emphasis on teamwork, poor development of student inquiry skills, and an inadequate portrayal of context of major users and problems" (Boud & Feletti, 1991, p.15).

A call for educational reform came from a variety of sources. External groups like state governments, corporations, and private funding agencies criticized the state of education in the United States. Cross (1994) stated:

> The educational reform movement started in the political arena with the report of the Secretary of Education's National Commission on Excellence in Education (1983). The report, entitled *A Nation at Risk*, was a serious indictment of American education, making memorable such phrases as "the rising tide of mediocrity" and "unilateral educational disarmament". (p. 686)

Criticism from within the profession came from both educational associations and faculty. Higher education associations encouraged educators to decrease dependence on lecture. Educational psychologists called for more active student involvement in learning activities. Barr and Tag (1995) summarized the situation by saying that they believed the education problem to be so serious that a paradigm shift from teaching to learning was needed.

<div align="center">Problem-based Learning and Educational Theory</div>

This mismatch between educational theory and practical application exemplifies the need for educational reform. Problem-based learning is seen as having the potential to provide a method of implementing needed change.

> Educational research demonstrates that:
>
> (a) Active learning is more effective than passive learning, (b) To be remembered, new information must be meaningfully connected to prior knowledge, and it must first be remembered in order to be learned, (c) Information organized in personally meaningful ways is more likely to be retained, learned, and used, and (d) Motivation is alterable, and can be positively or negatively affected by the task, the environment, the teacher, and the learner. (Angelo, 1993, pp. 5-7)

This is not a comprehensive list of educational research findings but it includes examples that reflect current educational theory addressed by PBL.

Students should be active learners and faculty should be facilitators of learning. Duch (2001) stated that " . . . it is necessary that students think critically and analyze and solve complex real world problems, find, evaluate and use appropriate learning resources, work cooperatively in teams and small groups, and use content knowledge and intellectual skills to become continual learners" (p. 6). Problem-based learning is designed to facilitate this level of student involvement in learning. It is also a student driven method where teachers function as facilitators, and is based on students' need for information rather than on information presented (Barrows, 2000; Boud & Feletti, 1997).

To be learned, new information must be meaningfully connected to prior knowledge. Schmidt (1983) stated that PBL provides " . . . a means for students to optimize learning by helping students activate relevant prior knowledge; providing a context that resembles the future professional context as closely as possible; and stimulating students to elaborate their knowledge" (p. 12). Learning in context is necessary for developing interdisciplinary skills essential for all professionals, but providing the correct learning environment is not an easy task. Klein and Newell (1996) stated that the highest level of interdisciplinary organization of professional education

> " . . . is a conscious effort to integrate material from various fields of knowledge into a new, single, intellectually coherent entity. This demands understanding the epistemology and methodology of other fields and, in a team effort, requires building common vocabulary and assumptions" (p. 404).

PBL may provide this level of interdisciplinary organization.

Current educational theory proposes that learning is an individual process and that each learner organizes information differently. Information organized in personally meaningful ways

is more likely to be retained, learned, and used. Problem-based learning facilitates the individual learning process, allowing students to become self-directed learners. Curry and Wergin (1993) stated " . . . that learning how to become a self-directed learner should be part of any professional education curriculum" (p. 354). They believe this is necessary because professionals must be able to make and respond to changes in their disciplines, and professionals must continue to learn while in practice. They must respond " . . . to changing context or conditions; thus most professional practice change results from self-directed learning rather than traditional continuing education programming" (Curry & Wergin, 1993, p. 354). Schmidt (1983) goes as far as to say that "PBL may solve problems of medical education like irrelevance of subject matter, the need for continuing education after graduation, and the inability of students to make appropriate use of what they have learned" (p. 11).

Vernon and Blake (1993) concluded from a meta analysis of PBL programs that both faculty and students thought of PBL as a positive experience. Boud and Feletti (1991) described Problem-based learning as a means of bringing about necessary educational changes in higher education. They (Boud and Feletti, 1991) believe that Problem-based learning provides a structure that can respond to " . . . how students learn, the expanding field of knowledge in disciplines, the need for education to reflect actual professional practice, update content, and regenerate enthusiasm among faculty in the face of a tight economic future" (p. 17).

Constructivism, which grew in adherents over the last 15- 20 years, is also evident in PBL. Appelfield (2001), Davis and Sumara (2002), and Perkins (1999) note that constructivism is rooted in work of theorists like John Dewey, Jean Piaget, Lev Vygotsky, and Jerome Bruner.

Although there are varying definitions of constructivism, Appelfield et al (2001) concisely define

it as an:

> . . . epistemological view of knowledge acquisition emphasizing knowledge
> construction rather than knowledge transmission and the recording of information
> conveyed by others. The role of the learner is conceived as one of building and
> transforming knowledge. (p. 37)

Components of constructivism evident in PBL include: (a) the learners' construction of their own

learning, (b) the dependence of new learning on student's existing understanding, (c) the critical

role of social interaction, and (d) the necessity of authentic learning tasks for meaningful

learning.

PBL is designed to provide students with the opportunity to construct their own learning.

This occurs at both the individual and group level. Students are responsible for personal

assimilation of information related to the problem. To promote active individual processing,

students are provided with sufficient time and resources needed to build their own understanding

of the problem. They are made aware of metacognitive processes in an attempt to help them

identify their particular style of learning, which promotes self-regulated learning. Self-regulation

is "the degree to which students are metacognitively, motivationally, and behaviorally active

participants in their own learning process" (Zimmerman as cited in (Evensen, Salisbury-

Glennon, & Glenn, 2001, p.660). This self-direction is also present in the group. As a group,

students identify the information and resources needed to solve the problem. The group then

establishes a plan for gathering resources, sharing information, and helping each other

understand information and concepts associated with the problem.

Constructivism asserts that we build on our present knowledge by connecting new information to what we presently know. To facilitate this process students are asked to hypothesize about the problem. During this step students are asked to draw on previous knowledge to make an association with a new problem. This step prepares the students for the new information they are about to receive. Recall of existing understanding is not limited to hypothesis generation, but occurs throughout the group meetings as students continue to share what they know in relationship to the problem.

The PBL group provides an environment in which the social interactions necessary for learning can occur. Students questioning their peers and responding to theirs peers questions become catalysts for learning. This give-and-take between group members is brought about by group design and encouraged by creating a non-threatening environment.

Finally, authentic learning or learning in context is actualized in problem-based learning through real world problems. Problems created for problem-based learning curricula must be designed to reflect what students are likely to encounter outside the classroom. In a physical therapy curriculum, patient problems are often taken from actual patient records. Problems are meant to be current and reflect patient populations that physical therapists will treat.

Overview of Problem-based Learning Curricular Model

PBL literature indicates that educators have developed a variety of methods for employing the educational concepts of problem-based learning (Boud, 1985; Boud & Feletti, 1997; Charlin, Mann, & Hansen, 1998). For example, problems are used as (a) a single learning activity within a course, (b) the starting point for all learning in a course, and (c) the starting point for all learning in a curriculum. This study examines groups that are participating in an

academic program where problems are the starting point for all learning in the curriculum.

Barrows and Tamblyn (1980) explain curricular problem-based learning as a way of constructing

and teaching courses using problems as the stimulus and focus for student activity. It is not

simply the addition of problem-solving activities to an otherwise discipline-centered curriculum,

but a way of centering the curriculum which is organized around key problems. Problem-based

learning courses start with problems rather than with the exposition of disciplinary knowledge.

Students move toward the acquisition of knowledge and skills through a staged sequence of

problems presented in context with associated learning materials and support from faculty.

A problem-based learning curriculum must also be guided by a logical representation of

the profession. An architectural curriculum may be built around different areas of design, such

as commercial, residential, environmental, municipal, etc. Each problem within the curriculum

would require content related to design, math, engineering, marketing, communication, and so

forth. Similarly, the problems in a health care problem-based learning curriculum are often

designed around anatomical systems; consequently medical students may spend a semester on

problems related to the cardiovascular system, and another semester related to the nervous

system, and so on. Physical therapy programs often follow a similar design.

Following McMaster University, Southern Illinois University (SIU) was one of the first

schools in the United States to utilize a problem-based learning curriculum. Other schools that

have adopted problem-based curricula include Maastricht University in the Netherlands,

University of Newcastle in Australia, University of New Mexico School of Medicine, Harvard

Medical School, Sherbrooke University in Canada, and the University of Kentucky, School of

Medicine. This study relies heavily on Barrows' interpretation of PBL. Although he is not the

only source, Barrows provides detailed information about problem-based learning in his texts.

He also, along with other faculty from SIU, offers courses on how to design and implement a

problem-based learning curriculum.

Howard Barrows (1998), the founder of SIU's medical PBL curriculum, defines PBL as a

curricular process, which leads toward the following goals and outcomes:

> 1. to develop a systematic approach to solving real life problems, using higher order thinking skills (problem solving, critical thinking, decision-making)
> 2. to acquire an extensive, integrated knowledge base that can be recalled and flexibly applied to other situations.
> 3. to develop self-directed learning skills
> 4. to develop the attitude and skills necessary for effective teamwork with others working on a task or problem
> 5. to acquire life-long habit of approaching a problem with initiative and diligence, and a drive to acquire the knowledge and skills needed for effective resolution
> 6. to develop habit of self-reflection and self-evaluation that allow for honest appraisal of strengths and weaknesses and the setting of realistic goals. (p. 4)

When PBL is applied as a curriculum, it gives students the necessary time to develop

group skills, metacognitive skills, social skills and life-long learning habits. It also makes an

integrated multidisciplinary approach possible.   Becoming an effective group member usually

requires a semester and developing new metacognative skills may take several semesters.

Students also need time to develop social skills and life-long learning habits that will be

important to their future professional behavior and success. Such skills must be developed in a

coordinated effort over several semesters.

PBL is also interdisciplinary, meaning that each problem is designed to have students

address issues from a variety of fields. For example, a physical therapy student will need access

to content and faculty from disciplines such as anatomy, physiology, physics, and kinesiology to

work through a single problem. The structure of a content-driven course in a series of courses,

offered in a single discipline, does not provide the flexibility to offer interdisciplinary content.

There is not sufficient time in one semester, and rarely adequate cooperation between disciplines,

to offer PBL as a single course in a traditional curriculum.   For a traditional curriculum to

become truly interdisciplinary would require, not just a modification of a single course, but a

new curriculum.

Barrows' PBL model not only organizes curricular content around problems, but it also

provides a complex structure for delivering the curriculum. The structure is a highly organized

nexus of learning experiences, resources, and assessment techniques. The central component of

this methodology is the student group, which Barrows (1998) calls a tutor group.

Barrows (1998) describes tutor groups as small groups consisting of six to eight students

and a tutor, a facilitator. Initially the facilitator's role is to teach the students how to work as a

group and guide students to predetermined outcomes based on the objectives of the problem,

course and curriculum. Guidance is tempered to allow the students to direct their own learning.

The tutor's role of teaching the group how to function, decreases as the students become more

familiar with group work. Working in groups, students move through the curriculum problem by

problem.

Barrows (2000), Boud and Feletti (1997), and Saarinen-Rahiika and Binkley (1998)

explain that problems are also designed to be multidisciplinary and to direct the student's

exploration of curricular content, often, in a simple to complex sequence. For example, physical

therapy students might receive a problem constructed around a patient with a single diagnosis

before receiving a problem related to a patient with multiple health care problems. As another

example, an architecture student would begin with problems that have few design and

engineering challenges in the early part of the curriculum and progress to more complex problems later in the curriculum.

Problems are designed to be a well-orchestrated blend of content from different disciplines. This mixture of content from different disciplines contributes to the complexity of the problems and reflects real life situations. In a health care curriculum, such as physical therapy, the product may be a detailed treatment plan with justification based on the patient's problems. Such a problem would be designed to direct students to explore content from several disciplines such as anatomy, pathology, physics, chemistry, and psychology. Successful resolution of a problem requires support from every discipline whose content is associated with the problem. Problem-based learning curriculum designers must be able to predict the resources the students will need as they progress through the curriculum.

The final component of PBL's complex structure is assessment. To insure that testing methods match educational methods, assessment must be an integral part of the overall process. Student assessment in PBL curricula varies, but many PBL programs are competency-based and use a pass-fail system. In such a system students are required to meet predetermined acceptable levels of performance. Competency-based performance is easily incorporated into health care curricula because these professions have developed clearly defined acceptable levels of didactic and clinical student performance. For example, the Committee for Accreditation of Physical Therapy Education (CAPTE) establishes guidelines in physical therapy for both didactic and clinical competency levels.

Several studies (Barrows, 2000; Duch et al., 2001; Magzoub, Schmidt, Abdel-Hameed, Dolmans, & Mustafa, 1998) indicate that testing is designed to correspond to the educational

process and outcomes, which often means that multiple measures are used to assess students. As examples, medical and physical therapy students may be evaluated through portfolios, multiple choice tests, essays, lab practicals, patient care practicals, oral examinations, objectively structured clinical examinations (OSCE), and group assessments. In physical therapy, as well as other professions, a student must demonstrate competency at each level of the curriculum before they progress to the next.

Problem-based Learning Effectiveness

Authors continue to debate the effectiveness of PBL. Differences in opinions often center on the program costs and learning outcomes. Colliver (2000) believes that overall PBL has not met expectations; he states " . . . that the expense of the programs both monetarily and in terms of faculty effort does not justify the returns" (p. 259). Others have also found that PBL can be expensive. However, they qualify their findings by stating that startup cost and initial faculty effort in developing PBL programs can be costly, but they emphasize that maintenance of PBL is no more expensive than traditional education. Colliver (2000) also claims that he did not find that a change to PBL made a significant difference in learning outcomes. Norman and Schmidt (2000) believe that Colliver's expectations are unreasonable for any curricular change, because what Colliver defines as significant would require the poorest performing student to move into the top 3% of the class.

Albanese (2000), Driessen and Vleuten (2002), and Nendez and Tekian (1999) also challenge reports that claim unsatisfactory PBL outcomes. They state that studies related to PBL outcomes are difficult to conduct and that evaluation techniques often do not match the PBL process. It is difficult to develop appropriate tools that are capable of detecting outcome changes

in any curriculum. If this is a problem with traditional curricula, it becomes a greater problem with non-traditional curricula for which there are no existing curricula evaluation tools. Not only are the correct tools not available, but also the evaluation methods left over from the old curriculum are often used, instead of designing new tools. This mismatch between evaluation tools and instructional methodologies may lead to misleading study results.

Faculty support of PBL can be found in several studies (Coulson & Feltovich, 1993; Distlehorst & Robbs, 1998; Dolmans & Schmidt, 1996; Remmen et al., 2001). The results from Vernon and Blake's (1993) meta-analysis show that PBL increases both student and faculty satisfaction and faculty contact with students. There is also evidence that students of PBL programs compare and in some cases outperform students from traditional programs on content-related exams and clinical skills. Whether PBL promotes life-long learning or helps develop more independent learners has not been verified or disproved since longitudinal studies have not been performed.

Structure and Function of the Problem-based Learning Group

As stated earlier the tutor group is the functional unit of PBL. Barrows (1998) describes tutor groups as being made up of 6 - 8 students and a tutor.   All problems are initiated in the group, and students work in groups for the length of the program. Students must be responsible members of the group because they rely on each other to share information and workload in the resolution of problems. All members of the group are expected to participate in the group process. Students are expected to ask questions, challenge each other and eventually become responsible for monitoring the function of the group. Group decisions are based on consensus.

Not challenging an idea is interpreted as acceptance of that idea. Frederiksen (1999) describes

the interaction within the group as being very much like the Socratic Method.

In the group the tutor functions as a facilitator. In the early sessions of a newly formed

group, the tutor is very involved in the development of the group. The tutor sets the mood and

explains the rules for group function. The tutor also encourages student participation and

displays the behaviors that the students are expected to develop. The tutor gradually decreases

his/her input to the group as the students develop group skills.

Students improve their group skills as they progress through the curriculum. Students are

expected to gradually assume control of the group. Through the group process, students become

more skilled at solving problems that arise within the group and learn to function as effective

team members. They learn to challenge each other in a non-confrontational manner and still

present their opinions within the group. It is hoped that besides developing cognitive and

metacognitive skills the group process will also develop communication skills necessary for life

beyond the classroom.

Barrows (1998) outlines a series of steps for each group meeting that reflect the most

commonly employed PBL group process. These steps are (a) generation of hypotheses, (b)

gathering of facts related to the problem, (c) recognition of learning issues, and (d) plan of

action. Following introduction of members of the group and the rules of group function, students

receive a problem. The next step is hypotheses generation. Hypotheses may be related to

anything in the problem statement. As an example, a problem about patient care may stimulate

hypotheses about the patient's diagnosis, prognosis, signs and symptoms, functional limitations

and disabilities. These hypotheses are recorded for future reference. Once hypotheses have been

exhausted students seek information, facts, that they deem necessary for solving the problem and verifying their hypotheses. Facts could include additional information about the patient's history, lab reports, more signs and symptoms and so on. During this process some hypotheses may be eliminated and new ones may be generated.

Hobus, Schmidt, Boshuizen, and Patel (1987) believe that using this method allows students to practice hypothetico-deductive reasoning, which they will use in their early years of practice and in later years of practice when they are faced with unfamiliar cases. The problems presented to the students may also allow them to develop what Schmidt, Norman and Boshuizen (1990) call "scripts", pattern recognition of different patient problems, which is associated with expert reasoning.

The next component of the process is the generation of learning issues (LIs), which are facts, concepts, ideas, etc., which the students need to understand to work through the problem. Finally the students must develop a plan of action prior to ending the group session. Planning covers a wide range of group functions that include tasks like dividing the LIs among the group members to establishing a time for the next meeting (see Appendix B for a detailed example of group structure).

Barrows (1998) describes the PBL group meeting as follows. There are generally two to three group meetings per problem. The first group meeting is used to: define the problem, create hypotheses for the solution or any other aspect of the problem, determine what knowledge group members bring with them that can be used to help understand and solve the problem, determine what the group and individuals do not know but need to know, and develop a plan. The second meeting is used to present information that the students have gathered to solve the learning

issues. Students present what they have learned since the first meeting. Students must present

information as it relates to the problem. Presentation of information usually is in the form of a

discussion; mini-lectures are not permitted. During this sharing of information one student is

responsible for being prepared to be the group content expert on a given topic. It is not

acceptable to provide handouts with information about the learning issue without explaining the

content in your own words. All information is presented in reference to the problem. This is

done to insure the presenter understands the information and to leave the topic open for

discussion. In some instances a third group meeting may be necessary as a follow-up to

additional learning issues (LIs) and to finalize the group product. Group products could be a

patient note, a skit, a poster, or any activity chosen by the group or assigned as part of the

problem. This process will be repeated with each problem, and there may be several problems

for each academic term for the length of the curriculum.

Between group sessions students consult resources and take time individually to process

new information. Multiple resources are made available to students. Some of these resources

are books, periodicals, internet websites, electronic media, lab sessions, lectures, question and

answer sessions, content experts, and fellow students. There are also more formalized meetings

such as lectures, question and answer sessions, and labs.   A variety of easily accessible

resources makes it possible for students to self-direct learning in a way that complements their

learning style. During this individual time students also prepare for the next group meeting,

knowing that they are responsible for bringing information back to the group for discussion.

Educational Outcomes of Group Work

The group process is interplay between tutor and student and between student and student, and this process has been shown to have beneficial pedagogical effects. The group process is designed not only to introduce the need to learn but also to assist learning. The group process as defined by Barrows (2000) requires students to use prior knowledge, participate in dialogue about subject matter, and work with peers. Recall of prior knowledge has been shown to help students integrate new knowledge and, if necessary, change the way they have organized information. Recall also helps students relate to the new problem and become invested in the problem. Participating in dialogue promotes retention of information. It also allows group members to compare their beliefs to the beliefs of others, which in turn lets them correct faulty thinking early. Duek (2000) and Norman and Schmidt (1992) have found that working with peers helps students understand and learn new information. Students feel freer to express ignorance around peers and peers can help clarify confused points better than non-peers. Peers can often explain concepts in terms that the other members of the group understand, and they may also have a better sense of what is causing the confusion. The group process designed by Barrows promotes all these components. It is therefore not unreasonable to assume that if Barrows' guidelines are followed the group should achieve the desired educational outcomes.

The incorporation of groups into the PBL methodology is linked to constructivist educational theory. The use of tutor groups, as structured in PBL, reflects the learning theory of dialectical constructivism or social constructivism. Applefield, Hubert, and Moallem (2001) explain that dialectical constructivism originates from the concept that there are three types of constructivism: exogenous, endogenous and dialectical.

Exogenous constructivism states that there is an external reality that is reconstructed as knowledge is formed. Thus mental structures develop to reflect the organization of the world. . . . Endogenous constructivism or cognitive constructivism emphasizes individual construction of knowledge stimulated by internal cognitive conflict as learners strive to resolve mental disequilibria? This process leads students to author their own knowledge, advancing their cognitive structures by revising and creating new understandings out of existing ones. . . Dialectical or social constructivism views the origin of knowledge as social interactions that involve sharing, comparing and debating among learners and mentors. Through a highly interactive process learners both define their own meanings and help others find meaning. In this way knowledge is mutually built. (p. 37)

They (Appelfield et al., 2001) interpret this view as a direct reflection of Vygosky's sociocultural theory of learning, which " . . .accentuates the supportive guidance of mentors as they enable the learner to achieve successively more complex skills, understanding, and ultimately independent competence" (p. 37).

<div align="center">Research on Problem-based Learning Groups</div>

The PBL tutor group, the central component of a PBL curriculum, is often the focus of PBL research. Several authors have provided insight into the various components of the group (de Grave, Dolmans, & van der Vleuten, 1999; Dolmans, Gijselaers, Schmidt, & van der Meer, 1993; Dolmans & Schmidt, 1994; Evensen & Hmelo, 2000; Glenn, Koschmann, & Conlee, 1999; Schmidt & Moust, 1995). The following examples include studies that primarily focus on the relationship between the PBL group and tutors, students, and the academic environment in which the group is set.

<div align="center">*Relationship Between the Problem-based Learning Group and Tutor*</div>

These studies primarily examine students in medical school PBL curricula. A variety of evaluation methods and measures are used including questionnaires, individual test scores, end of course grades, and the number and quality of learning issues (LIs) created by the group.

These studies may be qualitative, quantitative, or mixed, and the results are presented as best fits the type of study. When possible most authors statistically determine the correlation between tutor characteristics and an individual or a group outcome.

De Grave (1999) provided evidence that the level of tutor expertise has no effect on group test scores; yet, he found, like others (Dolmans et al., 1993; Dolmans & Schmidt, 1994) that while tutor expertise influences both group generation of LIs and individual assessment of group function, no studies were found that related tutor expertise to individual performance. Schmidt (1994) has also shown that when groups are led by tutors who are content experts they develop more LIs and assess group function more positively. Using the same measures, individual students rated satisfaction of the group process highest when the tutor was not only a content expert but also a skilled group leader.

Solomon (2001) has studied the use of students as tutors, which is an attractive alternative that allows faculty time for other academic responsibilities and provides the student-tutor with a rich learning opportunity. There is evidence (Dolmans et al., 1993) that the tutor, particularly in the early part of the curriculum, plays a major role in the success of the group but the tutor becomes less of a factor as students develop group skills. When test performance of faculty-tutored and student-tutored groups was compared, the results showed that the student-tutored groups, in some situations, out performed groups lead by non-expert faculty (Sorbal, 1994; Steele, Medder, & Turner, 2000). These results have been supported by Schmidt and Moust (1995) who attributed student-tutor success to "role congruence", the ". . . willingness of the tutor to be a student among the students, that is to seek an informal relationship with the students and display an attitude of personal interest and caring" (p. 709). A higher level of

congruence leads to better group outcomes, and the authors believed that student-tutors were more socially congruent than faculty.

Not only does the congruity of the tutor and the group affect PBL outcomes but the role that the tutor assumes affects group outcomes. This role, unlike congruity, refers to how formal a role the tutor plays in the group. Tutors tend to fall into two categories: (a) a tutor who may or may not be a content expert and who assumes the role of a group facilitator, and (b) one who may or may not be a content expert, who assumes the role of an information giver. Studies (de Grave et al., 1999; Dolmans & Schmidt, 1994; Schmidt et al., 1993) have shown that in some situations expert tutors are considered more effective when they stress the learning process in the tutorial group and not content. This may be interpreted as meaning that what is actually important to group function is guidance from the tutor and not whether the tutor is an expert. But, contrary to what one would expect, in some situations where the students knew that the tutor's role was that of a facilitator and the tutor attempted to stress the learning process, the students repeatedly tried to get the tutor to provide specific content information. Dolmans and Schmidt (1994) believed that this could be associated with the organization of the rest of the curriculum. They hypothesized that if students do not have other sources for content or if they had little time for individual study, they would attempt to use the tutor as a resource. Their interpretation supports the notion that the context, the environment in which the group exists, influences group function.

Relationship Between the Problem-based Learning Group and Student

Authors have primarily studied how the group affects students' characteristics. Problem-based learning is designed to bring about change in students' learning behavior and researchers

have attempted to measure this change. Evenson, Salisbury-Glennon, and Glenn (2001) showed that groups can have an effect on student behaviors outside of the group. The authors wanted to know if students in the PBL group process could alter old study habits and change from a method that relied less on what they thought the faculty wanted them to know and what was going to be on the test, to a method that relied more on what they needed to know in relation to the problem. The behavior that the researchers were interested in was self-regulation. The researchers measured student change using a qualitative method that required students to keep logs of their study practices outside of the group. Their results showed that outside of the group students had varying ways of using the group information and learning issues. They found that some students changed their degree of self-regulation and became more self-directed learners but others could not make the transition. The students who did not change relied on old patterns of self-regulation developed from years of learning to meet goals such as passing an exam. This meant that for some group members the intended result of the development of skills important for life-long learning was not achieved. It can be inferred that these results may be associated with individual learning styles and that some students may find it more difficult to make the transition because of their learning preferences, especially if they do not like group work.

According to Kolb (1981) a student's preferred learning style, assimilator, accommodator, diverger or converger may or may not suit them for group activities. To date no studies have been performed that look at the relationship between individual learning styles and PBL group performance. Duek (2000) designed a study that selected students for inclusion into groups based on learning style. But, his assignment of students to various groups was done to create homogenous groups, to control for the variability in learning styles.

Holen (2000) examined the relationship between the PBL group process and the combined characteristics of the students. He found that "Security, freedom, mutual respect, openness, and a certain tolerance for diversity are characteristics of the group that are considered beneficial to the efficiency of all small groups" (p. 487).

Relationship Between the Problem-based Learning Group and the Academic Environment

Finally, a study by Schmidt and Moust (1995) hypothesized that several factors outside of the PBL tutor group affected the group's function. They chose several of these factors and proposed a model to represent the relationship between these factors and the group. To test their model they implemented a mixed qualitative and quantitative study. Due to their large sample size and a statistical method called structural equation modeling, they were able to quantitatively demonstrate relative relationships between the various components of their model. However, their findings did not fully support their proposed model.

The researcher found this study particularly interesting because it provided a connection to his informal observations of how groups work. The researcher found that although the PBL group process is highly structured and supported by tutor and student training, groups may vary significantly from the intended group process. For instance, from my experience, when students are not given enough time to process information outside the group, they decrease discussion time and use the group to disperse information and use the tutor as a content resource. Based on Schmidt and Moust's work and the researcher's experience, the researcher developed a model to represent the context in which the PBL group operates. The components of this model are included in this study (see Appendix C for model).

Summary

Many of the mentioned studies indicate the significance if the relationship between the group and the PBL curriculum. This relationship is the focus of this study. This study however is unique because it examines the actual group process in the context of a PBL curriculum. Schmidt and Moust (1995) examined the relationship of the group to a PBL curriculum but they did not examine the group process in the detail that this study does.   A few studies actually observed and recorded the group process (Evensen & Hmelo, 2000; Glenn et al., 1999; Koschmann et al., 2000; Lemke, 1999) but the research questions were different than this study's questions.

Studies have been designed to examine the effect of the group on students and course outcomes. The usual method is to assess the group based on outcomes, such as LIs generated by the group, students' study habits, students' self-regulation, examination success, and group satisfaction. Tools used in these studies vary from questionnaires, examinations, logs, and interviews.

The assumption in many studies is that measures of individual or group outcomes are related to the group process (Duek, 2000; Mierson & Parikh, 2000; Solomon, 2001; Virtanen, Kosunen, Holmberg-Marttila, & Virjo, 1999). This is a reasonable assumption, but if the group process is not recorded, relationships between the group process, outcomes, and factors that may affect group process cannot be accurately assessed. Holen (2000) states that more studies need to examine the group process in detail. This study examines the group process in detail and relates the observed process to the context surrounding the group.

CHAPTER 3

STUDY RESEARCH DESIGN

This study examined group process in a problem-based learning (PBL) curriculum. The curriculum chosen for the study was a master's of physical therapy (MPT) program. As described in the introduction to this study, group work is an integral part of PBL and the way a group operates affects student, course, and curricular outcomes. It is also reported that the educational environment, context, affects the PBL group. The context in which a PBL group exists includes but is not limited to such things as the educational philosophy undergirding the program, faculty and student group training, faculty and student experience with group work, and faculty and student attitudes toward group work.

Research Questions

This study examined the PBL group process in a PBL curriculum to determine what occurs during group meetings and what relationships, if any, exist between the group process and the context in which the group functions. A more detailed explanation of the research design follows and is presented in relation to the study's two main questions:

1. What happens in the PBL group process and does it reflect the most widely used PBL group process?

2. How does the context in which a PBL group operates affect group process?

To address the questions an in-depth examination of two PBL groups in one physical therapy curriculum was performed. Question one was further divided into the following three questions: (a) Do the sample PBL student groups use the most widely applied PBL group

process? (b) Do the sample PBL student groups use the program's established group process? and (c) Are there differences in group process between groups working on the same problem?

Research Method

This research was conducted using a case study approach. Yin (1993) states that case studies are an appropriate method when ". . . you are trying to attribute causal relationships and not just wanting to explore or describe a situation" (p. 31). And, " . . . the major rationale for using this method is when your investigation must cover both a particular phenomenon and context in which the phenomenon is occurring" (p. 32). This type of situation often arises in educational research and is evident in this study where the phenomenon is the group process and the context is the variables believed to affect the group process. Yin (1993) further defines the case study as "An empirical inquiry in which the number of variables exceeds the number of data points" (p.32). The limited number of curricular PBL physical therapy programs and constraints of time and resources resulted in a small sample size.

I have also chosen a case study method based on the study's focus on a specific population, PBL groups. Several authors (Borg & Gall, 1989; Merriam, 1998; Van Dalen, 1962) describe a case study as an appropriate research method when a phenomenon, subject, or population is the focus of the study. Merriam (1998) stated, "I have concluded that the single most defining characteristic of case study research lies in delimiting the object of study, the case . . . . The case then, could be a person such as a student, a teacher, a principal; a program; a group such as a class, a school, a community; a specific policy; and so on" (p. 27). The object of this study is the PBL group.

Student groups are a defining characteristic of PBL and there is an assumption that there is a specific group process that is common to most PBL programs. This is a reasonable assumption based on the fact that many PBL curricular programs have adopted Barrows' distinct PBL curricular model along with its group process. Also, there are several programs (Queen's, 2004; Stanford, 2004; Tufts, 2004) that report using a group process that is like Barrows'. Barrows' model and curricular information from other PBL programs indicate that the most common PBL group process consists of the following components: (a) a group facilitator who is often called a tutor, (b) a group size of six to eight students, (c) a method of problem solving which promotes brainstorming or hypothesis generation, (d) time for both group and individual learning, (e) a Socratic method of discussion and sharing of information, (f) identification of learning issues, (g) a gathering of facts about the problem during the group meeting, and (g) group planning. However, there is little literature that documents the actual PBL group process used in curricular PBL programs. The researcher's experience has been that the actual PBL group process can vary significantly from a program's intended PBL group process and Barrows' model.

<center>Instrumentation and Analyses</center>

Data were collected using methods that seemed most likely to answer each of this study's questions. This resulted in the use of multiple methods including both quantitative and qualitative approaches. The sample size for this study is small, therefore quantitative values were not used to indicate the strength of relationships between variables or to generalize findings to a larger population.

Question One

Transcribed group sessions, questionnaires and student self-reports were used to determine the actual group process. All group meetings were recorded and the tapes later transcribed. Each student filled out three forms following each group meeting: (a) Student Group Evaluation Form (see Appendix D), (b) Student Evaluation of Tutor Form (see Appendix E), and (c) Student Self Evaluation of Learning (see Appendix F). After each meeting tutors completed a Tutor Self Evaluation Form (see Table 1 and Appendix G).

Table 1

Data sources for PBL Process

Source of Information	Location	Data Source	Purpose
Student	Appendix D	Student Evaluation of the Group	Examine Student opinions of the group process
Tutor	Appendix G	Tutor Self Evaluation	Examine tutor opinions about how they functioned in the group process
Student	Appendix E	Student: Tutor Evaluation Form	Examine student opinions about how their tutors functioned in the group process
Student	Appendix F	Student Self Evaluation of Learning	Provide information about what students learned during group sessions
Groups	Presented in Text	Student and tutor Transcriptions	Provide detailed information about group process

The Student Group Evaluation form was developed for this study and is based on a group evaluation form used by Faidley (2000) to evaluate PBL group performance. The original form

was developed by Performance Programs, Inc. of Old Saybrook, Connecticut. The researcher received permission from Performance Programs in March 2002 to adapt the form for this study. The Student Evaluation of Tutor and the Tutor Self Evaluation forms were developed by the researcher and other faculty members of the Physical Therapy Department of the Medical College of Georgia and are used to assess group work. The Student Self Evaluation of Learning was developed by the researcher for this study. The Student Evaluation of Tutor Form Student Evaluation of Tutor Form Questionnaires and student self-reports were used to collect student and tutor opinions of the group process and to determine the success of the group process. The questionnaires and self- reports also provided a means of checking, triangulating the researcher's interpretation of the transcriptions. It should be noted that an additional method for assessing the group, tallying the number of student identified learning issues, was not used. It was proposed in an earlier research design, but the groups did not clearly identify learning issues. Transcriptions were used to examine in detail what happened during group meetings.

Qualitative methods were used to examine and evaluate the PBL group process. The researcher followed guidelines established for qualitative research to establish validity and reliability. Merriam (1998) states that qualitative researchers must rely ". . . on careful attention to a study's conceptualization and the way in which the data were collected, analyzed, and interpreted, and the way in which the findings are presented" (p. 200). Merriam (1998) also believes that an organized and well documented approach to qualitative research is important so that readers can authenticate the findings of the study and judge the quality of the research. The researcher used organized methods and accepted means of searching and analyzing the data. To help with this the researcher used a software program, QSR N6, designed for ". . . keeping,

organizing and modifying . . . data, topics, categories, results, and research notes" (Richards, 2002. p. 3).

In preparation for data examination and analysis of transcripts the researcher developed a provisional data base template based on personal experience with PBL groups (see Appendix H). The researcher's experience as a tutor was with PBL groups that used Barrows' group process which was very similar to the study site's group process. Thus, the template that reflected the researcher's conceptualization of the PBL group process was a reasonable starting point. It included anticipated group member interactions and components of the group process such as the hypothesis generation, collection of facts about the problem, and the identification of learning issues. As data were collected the initial template was modified as needed to reflect new categories of information and variations in the study groups' process. Examination of the transcripts allowed the researcher to develop an accurate description of the group process and code unanticipated components of the groups' process. The software program generated a detailed record of the researcher's coding and transcript analyses.

Student responses to "Student Self Evaluation of Learning" were analyzed in a manner similar to the group transcripts. However, a provisional data base template was not created for this analysis thus categories were developed as the data were examined. This process was also qualitative and meant to provide an accurate account of the students' descriptions of their learning, and a means of searching for associations between student learning and the group process.

Descriptive statistics were used to analyze three questionnaires, including "Student Group Evaluation Form" (see Appendix D), "Student Evaluation of Tutor Form" (see Appendix E), and

"Tutor Self Evaluation Form" (see Appendix G). These questionnaires were used to assess tutor

and student opinions about group process. Students were asked to use a five point Likert scale

with responses from "Strongly Disagree" to "Strongly Agree" for the "Student Group Evaluation

Form". Both tutor evaluation forms required students to check one of four choices: "highly

effective", "effective", "not effective", and "N/A". The frequency of each response for all forms

was calculated per group and compared between groups. The results of these statistical analyses

provided descriptive information that was then examined in relationship to the qualitative

analyses of the group process. A statistical software program, SPSS, was used to analyze

questionnaire data.

Question Two

The second question asks, how does the context in which a PBL group operates affect

group process? The literature suggests that group process may be affected by a variety of

factors. Such factors can include but are not limited to the educational philosophy associated

with the program, faculty and student training in PBL group process, the faculty member's and

students' prior experience with PBL groups, the faculty member's and students' attitudes towards

group work, and the perceived role of the student and the tutor. As an aggregate these factors are

referred to as the context.

Data on context were collected using an individual general information form (see

Appendix I), a review of documents (see Appendix J), and requested interviews with the

program director. Questionnaires were used to gather information about group tutor and student

role identification, type and length of training for group work prior to the first problem in the

curriculum, and time spent on group process during group meetings in the first semester (see

Table 2). Documentation about the study program's educational philosophy and an interview
with the director of physical therapy program were used to supplement the questionnaires.

SPSS software was used to generate descriptive statistics from data obtained from the
Individual General Information Form. This information was used to develop an overview of the
characteristics of each group and all groups combined. Information obtained from the program's
philosophy statement and the interview with the program director was used to establish the
program's use and design of the PBL groups. To evaluate the relationship between the context
and the group process the researcher compared information collected from the sources listed in
Table 2 to information obtained for question one.

Table 2

Data sources for context issues

Data Source	Location	Source of Information	Purpose
Individual General Information Form	Appendix I	Student and Tutor	Gather demographic information
School Philosophy	Appendix J	Philosophy Statement	Determine the use of groups in the curriculum
Interview with Program Director	By phone and on site	Program Director	Determine the use of groups in the curriculum

Site and Sample Selection

On September 27, 2002 the University of Georgia's (UGA) Institutional Review
Board/Human Subjects Office approved an expedited review of this project (Project Number:

H2003-10529). The final approval of the research was contingent upon finding a site for the

study.   At this point, the process of selecting a sample site was begun.

The American Physical Therapy Association's (APTA) information about physical

therapy programs and the investigator's knowledge about different physical therapy schools were

used to target potential programs. APTA's Academic Program Information (2002) indicated that

there were four physical therapy programs in the United States that currently have a PBL

curriculum.

Next the researcher contacted potential programs by phone for an initial interview to

determine their willingness to participate and if they met the selection criteria. The criteria

included the following:

1. The program reports that they have PBL oriented curriculum.
2. Students work in small groups composed of 6-8 students and a group leader/tutor.
3. The same group process is repeated throughout the curriculum.
4. Problems are the starting points for learning.
5. The school can identify successful problems.
6. Students have had at least one semester or quarter functioning in a PBL group.

The first program, contacted in January 2003, fit all of the above criteria, and the program

director indicated that they had second semester student groups that would be addressing PBL

problems until they left for a clinical affiliation in the middle of March. The director of the

program stated that these students were comfortable with the group process, but continued to

need a group leader or tutor. Program faculty functioned as tutors. The director also stated that

these students would be working on problems that two previous classes had successfully used.

The director of the program agreed to participate in the study pending her personal

review of the research proposal, approval by the institution's human subjects committee, and a

willingness by the students and faculty to participate. (The name of the university will not be used in this study to comply with confidentiality requirements of the study.) After the director read the proposal and received verbal feedback from faculty and students confirming their willingness to participate, an application for approval for the study was submitted to the institution's Human Assurance Committee. The institution's human assurance committee approved the study on February 7, 2003.

Since the student population was several hours from the researcher's home, initial communications and preparations for onsite activities were done by phone. For example, after obtaining approval from both UGA and the research site, the researcher sent consent forms to the participating school (see Appendix K). The director of the program agreed to distribute these forms to students and tutors who might participate. Two student groups and their tutors agreed to participate in the study.

The researcher did not interfere with the assignment of group leaders or students to groups. One group had five students, and the other group had six students. The director of the program indicated that because of class scheduling one or both groups could have more than one tutor over the sampling period. This meant that tutor responsibilities for a given problem were shared but only one tutor was present during a group meeting. One group had one tutor and the other group had two tutors. The faculty planned three group meetings for the chosen problem.

A tentative data collection date was set for February 2003, a time when two second-semester groups would be working on the same problem. Data collection would occur when the investigator was on site, during the time of the three planned group meetings. The problem the groups would be addressing at the time of data collection was a problem designed to address

curriculum content related to cerebral vascular accident (CVA), commonly called a stroke (see Appendix L).

Data Collection

To prepare for data collection the researcher assembled a packet of questionnaires for each student (see Appendixes D, E, F, and G). The researcher also explored the pros and cons of different hardware and software. The researcher contacted the director of the Qualitative Inquiry Program at UGA by email and asked if she could recommend recording equipment under $100.00. She stated that she had successfully used Radio Shack equipment under $100.00. She also recommended using a Radio Shack boundary microphone for recording the group. The researcher also used recommendations made by Dr. Robert C. Peppard, Ph.D. from the Department of Communicative Sciences and Disorders at California State, Hayward. He (2002) recommended inexpensive equipment including the Radio Shack portable tape recorder CTR-117 and the Radio Shack Optimus Replacement Microphone (Cat. No. 33-3014). The researcher used both in this study. The Optimus microphone is an omnidirectional microphone, which is also capable of recording groups. One disadvantage of the omnidirectional microphone is that it recorded more background noise than a boundary microphone. He also stated that the voice activated option available on many recorders is not very useful since it often fails to record the very beginning of an utterance. The researcher also found this to be true when testing the equipment. The researcher disabled this option before recording the groups. The researcher based selection of SPSS and QSR N6 on the researcher's previous experience with both programs. See Appendix M for detailed equipment information.

Site Visit

Once on campus the researcher met with group tutors and the director of the program. The director gave the researcher a copy of the program's curriculum outline, their educational philosophy statement, and a copy of the problem the students would be using. The researcher had time to explain how the researcher would record the groups and what type of equipment the researcher would use to record the group meetings. The director of the program showed the researcher the department and introduced the researcher to other faculty and staff. The researcher was also provided with a work space and had access to a computer, email, the internet and a copying machine. The researcher was told that the office staff would help in any way they could. The researcher was not able to meet with the students at this time because they were in class.

The researcher was also shown the group meeting rooms. The rooms were adjacent to each other and removed from high traffic areas of the building. The conference rooms were identical with space for group members to sit around a large rectangular table. Overall, the rooms were comfortable and well suited for group work. The only physical problem with the rooms was the noisy heating system that created a high level of background noise on the tapes. The school's maintenance department corrected this problem by the third meeting. The researcher was told that the recording equipment would need to be removed after each meeting because other students used the rooms.

Student Orientation

Before meeting with students, the researcher was able to set up recording equipment in both meeting rooms. This required (a) connecting the recorder and the microphone, (b) connecting the recorder to an AC adapter, (c) positioning the microphone for the best pick up, (d)

placing a blank tape in the recorder, (e) taping the recorder wires and microphone wires to the table to both keep them out of the way and to protect the equipment, (f) turning on the microphone, and (g) providing an additional blank tape. After the equipment was set up, the researcher tested the equipment to make sure it was recording properly.

I met with students immediately before their first group meeting to explain the study, their role in the study, and to answer questions. The researcher reviewed the consent form with the participants, and they were again informed that they had the right not to participate, and that they could leave the study at any time without penalty. All of the students and tutors agreed to participate. During this meeting the students and tutors received questionnaires (see Appendix I) used to gather context and background information. Participants returned these forms immediately after the first group session.

<div align="center">Problem-based Learning Group Sessions</div>

I originally planned to record three group sessions. However, the schedule changed due to class cancellations caused by of a foot of snow the week prior to the researcher's arrival on campus. Due to a winter storm, the group meetings were rearranged which resulted in adding one additional meeting, totaling four group sessions. Groups were now scheduled to meet each Monday and Thursday over a two-week period. The schedule change created logistical problems by extending the researcher's time on site. The researcher reorganized his schedule and planned for an extended visit. However, by the third session the tutors and students felt comfortable with the taping process, and offered to record the last session. The chair of the department agreed to ship the recordings and the recording equipment back to me.

The researcher, with the help of the tutors and students, audio-taped the participants during each of four scheduled PBL group meetings; thus, eight sessions were recorded. The investigator was not present during group meetings. All recording equipment was set up prior to the meetings and the investigator or the tutors turned on the tape recorders just before the meeting started. At the end of each group meeting, the recording equipment was removed from the rooms in preparation for other classes.

The first group meeting lasted for approximately a half hour, and the remainder of the meetings lasted from one to two hours. At the end of each PBL group session, participants completed questionnaires and other forms provided by the researcher (see Appendixes D, E, F, and G). Completing the written materials usually took the students less than ten minutes. As students left the meeting room, they placed in an envelope the written description of their learning and their responses to the questionnaire. This procedure was used to protect student confidentiality. After the room was empty, the investigator collected the tapes and written materials

The taping of the final session, the session recorded by the tutors, worked well with the exception of one mishap. One powered microphone was not turned on during the last session and this oversight resulted in a poor recording. The built-in microphone on the tape recorder recorded this session, but this resulted in an inferior recording that was impossible to transcribe, and information was lost from this session. All other recordings were generally good with the exceptions of minor losses of information from heater background noise and students speaking too softly.

Data Presentation

Data are presented in a variety of forms. The researcher expressed quantifiable

information by using descriptive statistics and tables. The researcher treated transcribed group

sessions as qualitative information and presented it in a variety of forms such as descriptions of

the group process, summaries of group activities and themes and logical associations between the

group process and the context in which the group functions. The researcher also used direct

quotes and paraphrased portions of the transcripts to supplement descriptions and interpretations.

Indexing categories used in QSR N6 are included in Appendix H.

Confidentiality

The study design protected the privacy of the participants and the institution. Raw data

from this study will remain confidential. Only aggregated data and anonymous quotations and

findings are reported herein. Under most circumstances, the only identification necessary is the

date of the session, assigned group letter (A or B), and student number. Names that were

recorded during taping will remain on the audiotape do not appear in the transcripts.

The only other person besides the researcher who had access to the data was a

transcriptionist who had no means of associating a participant's voice with any other information

such as the institution, or the participant's age and appearance. The transcriptionist will also

honor data confidentiality. In the event that a participant is quoted, a pseudonym was assigned.

The researcher has not and will not identify individuals, the institution, or program by name in

any literature, nor will the researcher refer to the location of the school.

CHAPTER 4

RESEARCH FINDINGS

The purpose of this research was to examine the PBL group process in a Master's level physical therapy PBL curriculum. This purpose is further defined by the research questions:

1. What happens in the PBL group process and does it reflect the most widely used PBL group process? (a) Do the sample PBL student groups use the most widely used PBL group process? (b) Do the sample PBL student groups use the program's established group process? and (c) Are there differences in group-process between groups working on the same problem?

2. How does the context in which a PBL group operates affect group process?

This is a case study that uses both qualitative and quantitative methods to answer the research questions. A variety of data were used to answer each question. These data came from transcriptions of PBL group meetings, questionnaires, interviews, and written materials related to the sample physical therapy curriculum. The research findings are presented in two major sections: findings on the group process, and relationship of context to group process.

Demographics

Demographic data is presented first to provide the reader with background information about the study's research groups. The study population consisted of eleven students and three tutors. The students were second semester students in a problem-based learning master's of physical therapy program. All students had one semester of experience as members of a PBL group prior to this study and none of the students had any previous experience in PBL before

entering the physical therapy curriculum. Faculty assigned students to groups at the beginning of the semester prior to this study. This study allowed students to remain in these groups. The students were divided into two groups, one group of six and one group of five. Group A was composed of four females and two males; Group B contained four females and one male. The average age of the students for Group A was 24 years old and for Group B 22 years old. The age range for all eleven students was 22 to 31. Group A had two tutors over the four group sessions related to the problem. This occurred because the tutor usually assigned to the group had to miss one session because of other obligations. The tutor who took her place for the second session had experience as a tutor but had not met previously with this group. All tutors also had classroom responsibilities, so the students knew them in roles other than their tutor role. The tutors' ages were 31, 36, and 55.

Findings on Problem-based Learning Group Process
Related to Most Widely Used Problem-based Learning Group Process

Data were collected during the time the groups worked on one problem titled Case 12 - Mr. Hwa Yuan (see Appendix L). Transcriptions were used to examine in detail what happened during group meetings. The provisional template that the researcher developed provided a starting point for this examination. During analysis the researcher found that not all of the categories of the provisional template were needed and that new categories had to be added. Most of the new categories were related to the problem's objectives (see Appendix N). The students also addressed topics that were neither stated in the problem's objectives nor included in the original template. These included risk factors, aphasia, apraxia, and health care cost.

Collected data were used to determine if the study groups demonstrated the following components of the PBL group process: (a) a group facilitator who is often called a tutor, (b) a group size of six to eight students, (c) a method of problem solving which promotes brainstorming or hypothesis generation, (d) time for both group and individual learning, (e) a Socratic method of discussion and sharing of information, (f) identification of learning issues, (g) gathering facts about the problem during the group meeting, and (h) group planning. Based on PBL group design, both groups had tutors and the size of both groups did not exceed the usual PBL group size. The other components (c - h above) of the group were not as easy to identify and required a thorough examination of the group transcripts to establish their presence or absence. Data describing the groups' use of each of the components are summarized below.

Hypothesis Generation or Brainstorming Ideas

In Barrows' (1998) outline of the PBL group process, hypothesis generation is the first step in the group process. Students are asked to hypothesize about the problem and their hypotheses are recorded and revisited to see if facts of the case support their original hypotheses. When the transcripts were examined there was no evidence that the students identified hypotheses, recorded hypotheses, or revisited hypotheses as a component of their group process. However, an informal process did occur during which the students made hypotheses and showed evidence of brainstorming. This informal process of hypothesizing and brainstorming can be seen in the way the groups approached the topics of physical therapy examination, pathophysiology, differential diagnosis, and physical therapy treatments.

Throughout this chapter tutors are identified T1, T2, and T3 and students are identified S1, S2, S3 etc. Groups are identified as Group A or Group B and group sessions are identified

by group session One, Two, Three, or Four. The following text uses this system to identify

examples of the students' hypothesizing and brainstorming.

Physical Therapy Examination

Group A, Session Two
S1: All right, for exams the things I came up with, um, I guess that you
    do that. The charts, um, ... looking at his prior level of function, meds he's
    currently on, tests or, what has been done to the point when you're looking at it.
    Prior, meds history, family, history, I thought stress, level would be important to
    know, reports on diet, smoking, drinking.

S3: If we're going to do the exam first, I think we need to go back from
    like, I think we rushed through it too quickly. When we did systems,
    like, decreased sensation, I think we need to talk about, like, what
    sensation are decreased like, through the middle cerebral artery, you
    know, he's going to have um, like what patterns and stuff like. I know
    that weaknesses would be in the upper extremity . . .

S3: I think it's also important to note, sort of like the location and
    that's one specific artery, like the middle cerebral, and there's
    difference between right and left deficits too.

Group B, Session Three
S1: Neuromuscular, look for any pain or numbness, a possible loss
    of sensation on the contralateral side, ataxic gait, balance and
    coordination impairments are likely and hyper or, just check reflexes to
    see if they are hyper or hypo to direct you towards where if it's an
    upper motor or lower motor problem.

S2: Musculoskeletal (pause) We know that his strength is decreased on the
    right side and there's going to be a decrease also in the range of motion.
    Overall it could be seen also as age related.

Pathophysiology

Group A, Session Two
S1: Well, musculoskeletal, you're initially going to have the um
    decrease in tone, hypotonicity . . .and then as it progresses you're
    going to have increase in tone, um, and that's the same with reflexive,
    initially you're going to have the hypo-reflexive and hyper-reflexia, um,
    decreased range of motion, strengthening, I just figure because of the

tone can be decreased . . . don't have any more neurons going to those muscles it will cause some problems.

Group B, Session Two

S5: General physiological changes are going to have, at this age, you would expect to find those changes, you'd expect, oh, possibly increase in blood pressure because of sclerosis and may find your decrease in strength and range of motion.

Differential Diagnosis

Group A, Session Two

S4: How about integumentary?

S1: I think you would want to look for bruises from, like, if you fell and so traumatic it's so traumatic you . . . fell and you can't remember, you know, maybe bruise would trigger it or at least you'd know a possible, use the color of it, is it a more recent fall? Um, look for a past surgery, like looking for scars, um, pressure sore formation because they have the decrease sensation depending on how long they've been in their bed, do a quick overview of their skin integrity.

Group B, Session One

S1: I would say, I mean I would say the differential diagnosis of the stroke. Altogether and then know what a stroke in different locations of your brain would do. It would be something totally different.

S3: We can start of with, um, possibly we have to narrow out the fact that it might be a migraine headache that typically has not residual effect, no numbness, ... They become worse with exercise or exertion. They typically last between four and 72 hours. Um, it's common to have sensitivity to the light or smell, and, um, we would also have some, some would be unilateral symptoms with that.

Physical Therapy Treatments

Group A, Session Three

S6: I think it's just what we went over today in lab, posture, sitting, bed mobility, transfers, and gait, right? That's what I would do.

Group A, Session Four

S2: Yeah, like throwing a ball, or reaching this way because they, they're slumped this way or reaching this way because they have neglect on that side, I mean there's just so much, like, do you write 10

interventions that I could think of for a stroke, I mean, I could think
of multiple . . . .

Prior to their first group meeting, faculty provided the students with written information about the problem, Case 12 - Mr. Hwa Yuan (see Appendix L). This information included a problem statement, facts about the problem, and the objectives for the problem. Based on collected information this appeared to be the usual process. During an interview with the program's director, the director stated that the faculty's usual practice was to provide students with problem objectives prior to the first group meeting for each problem. This was also supported by information from the students like the following comment of a student on the Evaluation of Learning form (see Appendix F), "Today we just received the objectives to go over for the next case". Providing the students with information prior to the first group meeting may have influenced the group process by making it possible for students to circumvent hypothesis generation. The researcher will address this in chapter five.

Time for Individual and Group Learning

Individual and group learning time is evident in group organization, student group participation, and student responses to questionnaires. Scheduling of group meetings allowed for individual learning time between meetings. Between meetings students develop learning issues and prepared for group meetings. Transcripts indicate that students came well prepared to discuss topics related to the case and were capable of providing references for the information they presented. Transcripts also indicated that students thoroughly discussed the problem during group sessions. Finally, responses to the Self Evaluation of Learning questionnaire indicated that students believed that learning occurred during the group process.

Socratic Method

The next section relates to evidence of the Socratic method. This method of exchanging

ideas was very evident in the transcripts from both groups. The students and tutors appeared

skilled at exchanging ideas and respectfully challenging each other. It appears that the group did

not follow all the procedures of the model for PBL but they appeared to carry out one of the

basic functions of the group, which is the interactive exchange of information. The following

passages are typical of conversations that occurred during the group meetings.

Group A, Session Three
S3: The way that (instructors name) was describing it was that you have right and left
     pathways and they come down both sides and the right switches over to the left and
     the right and then the left switches over to the right and the left and if you cut the left
     one, that field on the right side of the right field would be gone and the right field on
     the left side would be gone.
S2: So it would be like out here and in here?
S1: So you're pretty much blinded to that side.
S5: This black part is the part where you are blinded at. And it would be on the side of
     the lesion.
S6: The same eye? Do both eyes have it on the same side? Correct?
S5: Yeah, it would be the medial side on this side and the lateral side on the temporal
     side. I don't know how to word that right.
S3: So like if this is cut right here, right one would begin uh then this left one would be
     going to this one and…..then the other one would be going to that side…, so if this is
     out.
T1: Yeah.
S5: And he's right hemiplegic so the temporal side is going to be affected on this side..
     If he was left hemiplegic then it would be the opposite.
S1: So he can't see the right side, correct? I'm just making sure I have it in my head
     correctly. That that's what it meant.
S3: So when they say which side it's on, that's the side they can't see on?
S2: Right , that would be the side that's on the temporal that you lose the temporal half .
     . . right Scott?
S5: Yes
S2: So if he was right sided, then he's going to lose the lateral of the left and the medial
     of the or the opposite, lateral of the right medial of the left.
S3: Can you define that - neglect?

S1: Okay. I'm not going to pay any attention to the fact that this is here, like suddenly
transferring into nothing. Well OK I see what your saying. There is a difference, but
there are people who, you have to rotate their plates, because they don't see this half
of the plate of food. This is midline of the plate and they don't see it over here.

S3: So they will just like, because they can't see it, they won't pay any attention to it?

S1: They see the corn but they don't see the chicken.

S3: So they won't like turn their head.

S1: They don't think anything is there - like you turn your head to me . . .

S3:   So they will just think there's nothing there so they won't turn
their head . . .

Group B, Session Two

S5: I willing to bet that smoking damages the cells, you have a good
point but why would smoking be bad if it causes temporary
vasoconstriction, part of it really, you know, long term risk factors if
it didn't do some kind of damage, permanent damage?

S1: Like also with someone that smokes their skin may age faster. At least from people
I've known.

T3: Well the skin isn't necessarily going to kill them or cause a stroke.

S1: No, but. It's got to do something , you know how they talk like this (she changes her
voice to sound hoarse.)

S2: So now where are we?

T3: I'm not finished yet. If you have ischemia occurring, or if
vasoconstriction, what does the cell need in order to survive?

S2: Oxygen.

T3: Yes. So you see that may be part of the whole process of cell
deprivation of nutrition. But why one location over another?

S2: And that we don't know.

T3: I do not, that's why I'm saying you need to ask Lisa if there is
anyway to prove why certain areas are more affected than another and why.

(Multiple voices and mumbling)

S4: If we knew we would probably be able to prevent them better.

S5: Unless the only thing that we have mentioned so far in this term that may suggest is
the bifurcation like that's an area more than others why it would occur there more
than others because of the turbulence in the split and the pressure up against the walls
will cause damage of them but other than that specific thing. We have not talked
about anything else.

Evaluation of tapes and transcripts indicated that members of both groups engaged in the

Socratic method. There was evidence of respect and acceptance each other's ideas which

promoted a free exchange of ideas. There was no evidence in any of the recordings of unkind or antagonistic exchanges between group members.

Fact Gathering

Students did not gather facts about the problem during their group meetings. They received facts about the problem from handouts, which eliminated the need for fact gathering during group meetings.

Generation of Learning Issues

In response to a given problem students typically generate learning issues (LIs). Niederhoffer (1999) defines LIs as actual topics or questions that begin to define the information necessary to understand the PBL problem. Barrows (1998) states that " . . . learning issues should be identified and recorded whenever knowledge or skills to understand appropriately or deal effectively with the problem or aspects of the problem are found to be lacking in the group" (p. 51)" A well-constructed problem will stimulate students to generate learning issues that address the objectives of the problem.

The process of identifying and recording LIs usually occurs as a distinct component of PBL group meetings. As such LIs are labeled as LIs and recorded by the group. Students in the study groups did not appear to use this process. Like hypothesis generation and brainstorming there is no evidence that the generation of learning issues was an established formal component of their group process. The process of identifying, recording, and discussing learning issues was replaced by group discussions about the problem's objectives and other topics which the students did not understand. Following data collection the director of the program confirmed that the

groups do not use a formal process within the group for identifying LIs. The director also

indicated that students are encouraged to develop their personal LIs before coming to the group.

The following excerpts of the transcriptions are examples of the students discussing

information related to the problem's objectives. These excerpts are followed by examples of the

students discussing information not directly related to the problem's objectives.   Both categories

demonstrate the group's ability to: (a) address the objectives of the problem and (b) identify

information pertinent to the problem. Although the following categories were not labeled by the

group as LIs they fulfill Niederhoffer's definition of LIs and thus will be referred to as LIs for the

remainder of the text.

Examples of Learning Issues Related to the Problem's Objectives

Group A, Session Three
S1: The difference between physical therapy and skilled and then depression. Did
     everyone have those two?
S4: What about the feeding tube? Can we do that first?
S1: Yeah, well that kind of goes with the safety factors issues so yeah. Go for it girl.
S1: Want to talk about incontinence at all?
S1: Should we talk about depression… and frequent depression…?

Group A Session Four
S1: Did anyone else have stuff on the communication? Because I know it's not up there.
S1: Anyone, stuff on impact of his family?

Group B, Session One
S4: Everything about strokes, medical management, treatment, disease

Group B, Session Two
T3: . . .so in other words you want . . . general and objective and get
    them done. Is that right?

Group B, Session Three
S2: Want to do preventive? What else did we say, like the strengths
     deficits or . . . . The head control . . . poor head control.
     Did somebody say 'onset of symptoms?' I need description. Headaches,

any stumbling or vision loss? Numbness. (pause) (Shuffling paper) Is it
in your history that you do the mental status check? Or is that later?
S5: Do we have time to make a problem list? Safety factors?

Review of the tapes and transcripts indicated that the students were engaged in active and thoughtful examination of the problem. This was true of both group during all sessions. Conversation flowed smoothly with the students requiring no urging from the tutor to engage in the discussion. Although not indicated in the above examples students at time talked over each other in attempts to express their ideas.

Examples of Learning Issues not Related to the Problem's Objectives

The following are examples of learning issues generated by the students that were not covered in the problem's objectives. Areas presented are related to documentation, cost, aphasia, apraxia, and dysarthria.

Documentation.

Group A, Session Three
S5: It's been my experience with liaisons from other facilities, they don't really
necessarily evaluate the patient, like have them go through things, they come to the
therapist and say what do you see? What do say what do you think? And they read
the notes and that's everything.

Group A, Session Three
S1: Did she put it on because she was incontinent or maybe just put it on because she
was exercising because exercise increases the bowel movement and she might not be
able to hold it long enough to get to the bathroom.   I didn't read in her chart that she
was incontinent.
M2: Like we were told that even when you go in and see something on a
chart, you need to test it just to know, you know what I mean?

Group A, Session Four
S4: The only, like, thing of writing interventions is you just have to like the SOAP
notebook helps a lot, if you write anything you have put frequency, where, how, you
know what? I mean, like if you just have someone sitting up in bed. I mean, sit up in

bed, that's your where, that's your what, I mean, how much, just how many times, you know what I mean?

Health care cost.

Group B, Session Two
S4: Those things (PET) are hard to find that . . . with limited accessibility and high cost.

Group A, Session Four
S2: If they work and somebody now has to stay home and there's the cost of having an extra person in the house.
S1: Cost of getting him there

Group A, Session Four
W: Why this expensive?

Group B, Session Two
S5: I got one thing I do want to share this. Before we, it's on skilled nursing. And because he's 70 years old, that he may be on Medicare and Medicare will PAY for a limited amount of skilled nursing facility care. And it will only pay for it if it's medically necessary and they won't pay for routine custodial care like nursing home care, and social assistance, ADL. It has to be a medical necessity. Um, Medicare benefits are limited to 20 days for full coverage, and subsequent 80 days of partial coverage. That's what we're looking at for coverage. 80 co-pay, 100 in total that they'll pay some portion
T3: Make sure you have time next time to look up, go to the government
website Medicare and find out what co-pay is, . At some point you will be covering the whole issue about time and RUG levels and just supposing this patient needs PT, OT and speech therapy and they're RUG level will only allow for 30 minutes. So you have to triage who gets the priority and more importantly, and that's what we'll talk about next time. We can discuss this more, but there is a time limit with Medicare.

Aphasia, apraxia, and dysarthria.

Group A, Session Two
S5: O'Sullivan has a table that has a little cerebral artery syndrome. It's paresis of contralateral face, arm, leg, sensory impairment over the contra lateral face, arm and leg, . . . speech disorder, expressive aphasia, um, . . . receptive aphasia, perceptual problems such as unilateral neglect, apraxias, depth perception problems, spatial relation difficulties, numbness hemianopsia, um, loss of conjugate gaze and ataxia.
S3: Wernike's or receptive aphasia

Group A, Session Three
S1: Global aphasia?
S4: Receptive and Expressive aphasia - they don't understand and they
     can't express to you.

Group A, Session Four
S1: Aphasia vs. apraxia and dysarthria

S4: The aphasia is actually like, the things more mental where the apraxia and
     disarrhythmia are motor. Disarhythmia is actually, it seems like it, disarthria is one of
     the apraxia. Does that make sense? Like apraxia is just a general disorder of
     voluntary movement and disarthria
S2: OK. is disturbance in the speech, and then it has like, due to emotional stress, brain
     injury or paralysis, incoordination, incoordination or spasticity of the muscles . . .
     And then aphasia is the whole like, global or receptive or expressive, where if
     repaired or
     absent comprehension of speech, writing or signs.
S3: Perseveration, perseveration, um, what, is that, um, kind of, expressive aphasia?
     Because Gina was explaining to us, like gave us an example of aphasia that only say
     cable, but she said that she knew that something was wrong, could tell by the kind of
     a voice and stuff like that, that that was the only word she could say, so that's the kind
     of expressive aphasia, or?

Group B, Session Three
S3: Speech problems. The speech, the expressive, aphasia that he is having may cause
     difficulty for us. So we may have to give out a yes or no to make sure they
     understand the difference between yes or no (short pause) all that.
S1: In O'Sullivan it explained that it with dysphasia there is difficulty swallowing, Um..
     and that can often occur with an infarcted MCA and it can be dysfunction in the lips,
     mouth, tongue, palate, larynx, pharynx, um, or those can contribute to dysphasia or
     um… an altered mental status, altered senses, poor jaw and lip closure, impaired head
     control or poor sitting posture can also contribute to it. So there's a variety of
     reasons why it occurs - the most common problem is delayed triggering of
     swallowing reflex and reduced peristalsis. Occurring with aphasia like one of the
     complications is aspiration and that's when food, liquid or saliva or any type of
     gastric reflux enters into the airways, and that can lead to acute respiratory distress,
     pneumonia and possibly death if untreated.   So the NG tube can be use to feed so to
     prevent, aspiration from occurring, or if it's used in a way to suck out the unwanted
     fluids, then it can be used in that way also.
S2: What about the aphasia?
S5: I think he would have the non-fluent or expressive aphasia - it's where the closed
     speech is slow, the vocabulary is limited and the syntax is impaired and speech

production is labored or absent. All comprehension is good. Seems like he is able to comprehend but unable to express what he needs or wants.

S4: There's the expressive or the comprehensive aphasia, the expressive is typically found where the Brocca's Portion of your brain's involved vs. the comprehensive is in Warnike's.

When the tapes and the transcripts of the group discussions were compared to the objectives for the problem it was clear that the majority of the students' conversation focused on the problems objectives. However the students also generated unique questions, questions not specifically related to the problem objectives. The researcher interpreted this as the generation of learning issues during the group process. The students were demonstrating the ability to determine what information they need to work through the problem. The ability of the group members to recognize their educational needs is an indication of an effective group process.

The absence of a formal process of identifying LIs during the group process was initially confusing because the researcher originally thought that LI identification was included as part of the study groups' PBL group process. An additional meeting with the director of the program clarified this point. This is discussed at the end of this chapter. Information collected about the program's group process indicated that students received the problem prior to their first group meeting and they then developed learning issues based on the problem. The students were expected to come to the first meeting with their individual learning issues. But, learning issues were not mentioned in any of the group meetings. Also, student responses to the Student Evaluation of Tutor Performance forms indicated that students in Group B marked N/A to items related to learning issues, while students in Group A marked the same items either highly effective, effective, or not effective.

Group Planning

In the model PBL process students determine the short term and long term goals of the group as they relate to solving a problem. For example, students should decide how the group will approach the resolution of learning issues. In doing so, students often choose to divide the learning issues among members of the group making each member responsible for one or more learning issues. Once assigned a learning issue a student is responsible for researching the learning issue before the next meeting and presenting their findings to the rest of the group. This process did not occur in the recorded meetings. It appears that each group member understood that they were responsible for all the learning objectives and the group would share information at the next meeting.

The planning that was most evidenced by the students was related to the immediate situation and the tutor often aided their planning. Students used brief questions or statements and occasionally short discussions about what to do next. The tutors' planning included both immediate and long term needs. Longer term usually related to up-coming meetings. No other planning was evident in the transcripts. The following are examples of both student and tutor planning.

Students

> Group A, Session Four
> S1: Did anyone else [find] stuff on the communication? Because I know it's not up there but.

> Group A, Session Two
> S4: OK. Well, we'll start with chart review.

> Group A, Session Two
> S1: All right, so are we going to do exam.

Group A, Session Two
S1: All righty, systems review. Do we have anything real good?

Faculty (Tutors)

Group B, Session Two
T3: . . . there are four sessions to this case. So we have [three more session left] unless
     we have another bunch of snow days.

Group B, Session Two
T3: All right, what have we suggested when we come back to do the session
     to bring that information back with you? There is no sense in doing a
     whole lot of anatomy, physiology here But I think the important thing is
     to know where is this vessel and what would be the part of and so on.

Group B, Session One
T3: Usually we try to get that in the first session, we should be trying,
     but if you don't then the second session we can do the exam.
S1: Three days on this thing?
T3: Yes, three days to finish the patient. Ok, for now I'll give you each your folders and
     then we won't have to do our homework on …these questionnaires.

Group B, Session Three
T3: What we'll do for next time, which is the last time on this case is
     we'll deal specifically with Treatment Interventions. I'll go over some
     of the Interventions.

Group B, Session Three
T3: Maybe but that's …..And I know that we, I think it was only in the
     last case that we had medication. What's he using? So let's revisit that.

The above examples were chosen based on there ability to convey that planning was part

of the group process. It should be noted that planning occurred to some extent in both groups

and during all meetings. But, during some meetings the planning was not significant enough to

present in this text.   Thus, the above examples are limited representations of the groups and the

sessions. It was evident from the tapes and transcripts that the students did not require formal

planning during the group sessions to determine their next step in the problem solving process.

The author interpreted both the lack of planning and the students' apparent comfort without planning as a result of their prior semester of experience with the group process.

Summary

Overall students in the groups did not use the most widely used method of PBL group process. They did not generate formal hypotheses during group meetings nor did they use the group meeting time to obtain facts about the problem. They also did not appear to have an established method of defining learning issues. Finally, students did not appear to do the detailed planning often performed by students as part of the group process.

What did occur in the meetings appeared to be a close approximation of the model PBL process. Students did generate learning issues but not as a formal process and according to the director of the program students were encouraged to develop learning issues outside of the group meeting. Within the group meetings the students never used the term learning issues. There was most likely a pre-planned method for the groups to handle the organizational needs of the group, such as an understanding that all students would address all objectives or learning issues. The need for students to develop learning issues during the group meetings was supplanted by their use of the problem's objectives as guides to information they needed to work through the problem. Students also received the facts related to the problem before the first meeting. This allowed them to develop LIs independent of the group meeting. Possible implications of this variation from the usual group process will be discussed in the next chapter.

Findings on the Problem-based Learning Group Process
Related to the Program's Intended Group Process

Much of the evidence related to the question, Do the sample PBL student groups use the program's established group process?, appears in the previous section. When transcripts are examined, the group process used by the groups appeared to follow the program's intended group process. This means that groups were working the way they were designed to work within the study curriculum. The consistency between groups, which is addressed in the following question, supports this conclusion. If major discrepancies between groups were noted, the assumption would be that at least one group was not following the established group process.

Although the group process did not contain hypothesis generation, identification of LIs, or fact gathering, this appears to be the accepted process for the study curriculum. Information provided by the program's director indicated that students received the problem and the problem's objectives before their first meeting, which would allow them to develop learning issues in preparation for the first meeting and bypass fact gathering during group meetings.

The only confusing evidence is the information provided by the program's director about LIs and the variability in student responses to the Student Evaluation of Tutor Performance forms. As previously indicated the director stated that students should generate LIs prior to the first group meeting and groups Group A and Group B responded to questions about LIs very differently. If students were intended to discuss learning issues during group meetings, it did not happen.

Transcripts already presented provide evidence related to the last question, Are there differences in group-process between groups working on the same problem in the same PBL

curriculum? These transcripts are representative interactions of all tutors and both groups of

students. They also represent a cross section of topics addressed by the groups. After listening

to the tapes and analyzing the group meeting transcripts, it appears that the two groups

functioned very much alike. The major difference between groups appears to be related to the

way tutors interacted with their groups. This will be addressed in detail in the next section under

Perceived role of the tutor. Additional examples from transcripts will be used to support the

claim that there are differences among the tutors.

<div style="text-align:center">Findings on the Relationship of Context and Group Process</div>

The second major question of this study was, *How does the context in which a PBL group*

operates affect group process? Context in this study is defined as the major components that

influence the PBL group process. They are (a) the educational philosophy of the program, (b)

faculty and student training in PBL group process, (c) faculty and student prior experience with

PBL groups, (d) faculty and student attitudes toward group work, and (e) perceived role of the

student and of the tutor. Written and verbal information about the study program's philosophy

was obtained from the director of the department. Other information related to the context was

obtained from questionnaires completed by tutors and students.

<div style="text-align:center">*Educational Philosophy of the Program*</div>

The program director provided information about the program's philosophy. The physical

therapy program selected for the study states in its introduction to the curriculum that:

> The problem-based learning model was selected for this curriculum because of its
> capacity for establishing a systematic clinical decision-making pattern, promoting
> development of skills in teamwork, developing student skills in critical analysis, and
> transmitting professional knowledge, skills and attitudes. The model stressed the process
> of learning as well as the content of learning. These abilities are important to the practice

of physical therapy today, and will be even more important as reflective practitioners in the profession guide its adaptation to the information explosion, managed care models, health care and information technologies and other changes in health care delivery.

Problem-based learning is well suited to a graduate program because of its emphasis on adult learning models and student responsibility for learning and other behaviors, because it facilitates sharing the diverse education and experience backgrounds of students and faculty members, and because it promotes the use of a variety of learning styles. Problem-based learning is student-centered, focusing on learning rather than on teaching. Student responsibility for identifying a need for information, locating and evaluating information, and assessing the performance of themselves and others is central to this approach. (from *The Curriculum: Introduction to Problem-Based Learning* supplied by the program's director)

A brochure supplied by the school describes the curriculum as:

. . . featuring problem-based learning with the early and continuing integration of basic sciences, clinical sciences and clinical skills. The emphasis is on student responsibility for learning. Group learning activities are used to develop skills in teamwork and collaboration to prepare graduates to participate in the evolving health care delivery system.

The director of the program also stated that all faculty understood the educational philosophy of PBL and were in agreement that they offer a PBL curriculum. This was possible because the curriculum was developed as a PBL curriculum, which meant that there was no transition from a traditional curriculum to a PBL curriculum. Thus they were able to avoid philosophical conflicts among the faculty. The curriculum was modeled after McMaster's PBL program. Some of the faculty received PBL training at McMaster.

Faculty and Student Training in Problem-based Learning Group Process

Data was collected to determine the extent of training for both faculty and tutors. The following sections provide information collected from questionnaires answered by faculty and students.

Faculty Training

Data collected about tutor training indicated that all the tutors had more than six hours of training. One tutor indicated that she had attended a two-day tutor training session at McMaster University. All tutors were experienced; one tutor had five semesters of tutoring experience and the other two tutors each had twelve semesters of experience (see Table 3). Two of the tutors indicated that they had access to additional tutor training while one indicated that she did not.

Table 3

Tutor Training

Tutor	Content Knowledge	PBL Group Experience	Training
T1	Average	5 Semesters	More than 6 hours
T2	Expert	12 Semesters	More than 6 hours
T3	Average	12 Semester	More than 6 hours

Note. Data is summarized from General Information Form (see Appendix I)

Student Training

All of the students indicated they had no prior experience before entering the curriculum. Since entering the curriculum the students had training in the PBL group process but they identified it in different ways. One student commented that she received some training when she came to interview for admission. Group B did not answer the question that asked specifically about hours of training; it was assumed that they decided as a group that the question did not apply to their learning experience. Group A picked the lowest amount of training, one to two hours.

When asked how many group sessions were devoted to learning the PBL process, four of the eleven students did not respond, one student marked zero, and six answered one. When

asked about prior experience as a member of a PBL group all students who responded indicated that they had one semester of experience as members of a PBL group, one student did not respond.

The task of educating students in the group process typically occurs during group sessions. As students address problems tutors help them learn the group process. During the early sessions there is time devoted to instructing students in the PBL group process and this may be the time that some students identified as either hours or group sessions used for learning the PBL group process. It is evident from the questionnaires that students had some training in the group process. The transcripts also showed that the second semester students functioned well in groups.

<p align="center">*Perceived Role of Tutor: Tutor Perspective*</p>

The stated role of the tutor is to be a facilitator. Transcripts and questionnaires were used to determine the role of the tutor in the sample curriculum. Transcripts were used to examine the amount and type of tutor input during group discussions. Tutor input was divided into the following tasks: monitoring, explaining concepts, answering questions, providing directions, questioning and verification. The following are examples of each task and are representative of most tutor interactions with the group.

Monitoring

The following interactions exemplify the monitoring tasks, which consist of checking ongoing individual or group progress such as awareness of understanding.

Group A, Session Four
T1: So where are we as far as treatment? Talking about bed mobility, any one have any other interventions for bed mobility? Can someone summarize bed mobility?

Group A, Session Four

T1: What else, you had mentioned an exercise earlier, doing active assist with the other arm, what kind of activities were you doing with that?

Group A, Session Four

T1: Any others? You don't have any other interventions? We hit transfers and that's it? That's all you're going to do with them? Progressive…. How about gait? How would you work on that, when he's ready.

Group B, Session Two

S1: It constricts.

T3: Yes they're vasoconstrictors.

Multiple people: Oh, oo, sighs, ahs

T3: Light bulb!

M: You're saying that they don't actually do damage ...to the vessel. I thought they, I thought smoking actually damaged the cells, did damage to the cells, I'm sorry. Multiple people; I did too, . . . what was the . . . alone . . .

T3: Oh my goodness! Multiple people: how bout that? . . . didn't know . . . that way! Gosh. Unidentified student: That is really wild, I never thought (pause) Oh, now we're, now we're really getting there!

Group B, Session Two

T3:   So do you notice a difference between the culture we're talking about and our western culture? Till today what is the difference?

Group B, Session Three

T3: Again, there are two different ways of looking at it. When you go through the litany of all the tests and measures that you would do, what would be appropriate for this patient? That's what we've really come down to.

Group A, Session Two

T2: Let's wrap up . . . a nice neat package down there at the end. So, we're in the chart review with you, we're doing our history, we're looking at medical management, right I mean both medications that were administered in your procedures that were done. Did we answer (student's name) question? Are there drugs given to an individual with a hemorrhagic stroke?

Group A, Session Three

S1: Thanks for the summary (tutor's name removed).

T1: It's not happening much today. I just wanted to remind you.

Monitoring was employed by all tutors during all sessions. Review of the tapes and transcripts indicated that the tutors were skilled at this process. Tutors were able to gently direct group discussion without imposing their personal need for structure on the students. The majority of monitoring tasks were appropriate and timely, and did not interfere with the flow of the group meeting.

Explaining Concepts

Explaining concepts is not the usual function of the tutor; it is normally the students' responsibility. When Hmelo-Silver (2003) studied PBL groups she found that

> The facilitator made few statements, rarely offering new ideas or modifying existing ideas. The facilitator was most likely to offer a comment monitoring the group's progress or encouraging students to consider that a poorly elaborated idea might become a learning issue. (p. 413)

She (Hmelo-Silver, 2003) also found that the facilitator made a total of 6.4% of all statements during a group meeting, the facilitator made 243 statements and the students made a total of 3763 statements.

When tutors are content experts, it is more likely that they will modify their roles as facilitators and become content resources. The problem that the study's PBL groups addressed was based on a patient who had a recent cerebral vascular accident (CVA or stroke). Only one of the three tutors, T2, considered herself an expert in this area. She did offer more specific information than the other tutors, which can be seen in the following excerpts from the transcriptions.

> Group A, Session Two
> T2: Not all of the time we're not saying it's the only way to prevent edema is to give them hypertensive, I mean, we can also administer other medications that are

designed to minimize the effects of swelling or of the blood basically being out where it doesn't belong with brain tissue.

Group A, Session Two

S2: Does there come a point . . . no, that's not what I wanted to say, okay, other than a basilar which you said was very bad, can you have a bad enough stroke or a stroke that is so involved in so many different systems at such a high level that you really can't do anything? You do just go through the exercises and . . .

T2: Absolutely. That's why we're asking the questions, we need to know, have some insight. Is it so profound that we don't expect a lot anyway? And again be careful that you don't get a preconceived notion . . . So how old is it? Have we missed that window of opportunity that the nervous system in it's recovery still has enough plasticity to it that we can affect it? Or is it so far . . . . Because I asked you where she lived and you said a skilled facility so the first thing I'm thinking as you described this patient with an enormous amount . . . is that she's been there a while and that her stroke is . . . so that maybe even years time frame where the rapid changes are going to be seen.. If it's an older stroke, my ability to impact that is significantly decreased. Because we've kind of missed that golden window of opportunity. So then I also from there would have to get into . . . I would have to play the game of how good was the intervention that she was offered? Okay, like the fact that you tell me she was in a cardiac chair and she was never taken out of it, that bothers me. Because my ability to teach her any kind of body awareness, any awareness in space, balance etc. in a cardiac chair is basically non-existent. Okay, then I have to question, was she in the right setting for her problem? Did she have the right type of intervention? What other ways can I help a patient that is as severe . . . ? Acknowledge themselves and be aware of where they are . . . and . . . ? How else can I intervene with her other than just move her around?

Group A, Session Three

T1: OK What about more medical management as it relates to elimination and ingestion? Has anyone been in a hospital room where you have seen input and output being monitored? If you get to the point where this person is more functional and can get to the restroom it's part of our responsibility to be active in that and if a patient has a bonnet that you need to put in for them to monitor the fluid output . . . then you need to be aware of that. Not just any patient , this type of patient, they might be monitoring what fluids they are ingesting and what is the fluid output as well. So if you're not sure about that, different hospitals have different policies about alerting people to that, just put signs in the bathroom with the patients' bed number on it, with their monitoring . . . . There will be bonnets in the toilet to catch the fluid so you can just tell nursing, Hey I just took this patient, and he voided and they can monitor and measure it. That's just a general acute care tidbit for you.

The tutor with the least amount of experience, T1, offered several long descriptions of her own experiences with patients but her interjections were not as content specific as those made by tutor T2. Tutor T3, with twelve semesters of experience, but not a content expert, did not offer as much content related information. All three tutors had a high frequency of making statements, higher than 6.4%. Tutor T3 from Group B tutor averaged 23% of communication for group meetings during sessions one, two, and three. In group A tutor T2 participation rate was 17% for Session two, and tutor T1's participation rate for sessions three and four was 13.5% (see Table 4).

Table 4

Tutor percentage of group participation

Group Session	T1 Group A	T2 Group A	T3 Group B
Session One			23 %
Session Two		17%	18%
Session Three	13%		27%
Session Four	14%		
Average %	13.5%	17%	23%

Note. (a) T2 tutored one session, (b) T3's session four was not transcribed because of the poor recording, and (c) T1's group did not have a group discussion during session one.

Answering Questions

Answering questions is an obvious part of the tutor's role, but what makes an effective tutor is how the tutor responds to questions. Some questions require a direct answer but there are times when a student's question can be used to help the student further explore the problem. The following examples show various types of responses to student questions.

Group A, Session Two

T2: That's a good question. Try to think of some specific examples. You're looking at these test and measures and saying how would I…. Right? So specifically, what comes to mind, let's talk about this.

Group A, Session Three

S3: I mean if we couldn't help incontinence, why do people lose it in the first place are we just supposed to sit back and wait for them to regain it for themselves. We have to. . . Doing range of motion on the arm is not the same as that reflex being gone . . . T1: You have to consider the ideology in the incontinence. There are different causes for incontinence and some that can be treated by specific interventions and some that just take neurological healing in order to come back. You have to look at the cause for it and find if it is something that we can address with intervention . . .

Group B, Session One

S2: Do we do a FIM (Students stray from topic.)

T3: Usually we try to get that in the first session, we should be trying, but if you don't then the second session we can do the exam.

S1: Three days on this thing?

T3: Yes three days to finish the patient. Ok, for now I'll give you each your folders and then we won't have to do our homework on these questionnaires.

Group B, Session Two

S1: Is this something that's permanent?

T3: Well think of any of the consequences of having had a stroke. He right now may be in the initial, the acute stage.

Tutors demonstrated the ability to vary their response to questions based student needs. When students required factual information to progress in the problem, the tutors' answers were direct. But, when there was an opportunity to challenge a student's understanding of a concept the tutors often answered questions by posing another question. The tutors' responses to questions complimented student needs. The tutors' questioning appeared skilled and at no time during any of the sessions was a tutors' questioning confrontational. Recordings and transcripts indicated that students respected the tutor's questions and made sincere efforts to respond. The tutors' questions often furthered and enriched the group discussion.

Directions

In PBL groups the tutors take some responsibility in directing the group. This responsibility diminishes as students become more experienced group members. Directing the group is different than "planning" because it immediately impacts the group process. The following examples demonstrate the tutors' influence on the group process.

Group A, Session Two
S1: We cannot do the exam part because we don't even know what we're examining. It has some words we don't even know in there.
S2: Do we have to?
T2: Start with chart review.
S5: Chart review.
S4: OK. Well, we'll start with chart review.

Group B, Session Three
T3: Okay, anything else on the history that you need to cover? [pause] Systems review?

Group B, Session Two
T3: Hang on to that until we get to that point and then we can talk about the different tests that would rule out this stuff or the other.

Group B Session Two
T3: All right, what have we suggested when we come back to do the session to bring that information back with you? There is no sense in doing a whole lot of anatomy, physiology here but I think the important thing is to know where is this vessel and what would be the part of and so on.

Tutors were usually waiting for students to direct the group. Tutors were directive when students were having difficulty making a decision or when the group strayed too far from a discussion topic. Tutors did not often direct the group process but did when it appeared that the students needed guidance. Students responded well to this guidance. It appeared that the tutors provided guidance only as needed. Information from tapes and transcripts showed that the above tutor directions immediately refocused the students. Once they interjected their suggestions they

waited to see how the students responded. Usually the students quickly assimilated the tutors' input and moved forward with the discussion.

Questioning

The students also gave the tutors relatively high marks in asking thought provoking questions on the Student Evaluation of Tutor forms. The following examples demonstrate the tutors' ability to ask questions.

> Group A, Session Two
> T2: Basically, along those same lines, all of the things that we do could be a medication or surgical, are geared to do what? In kind of layman summary terms what are we trying to do?

> Group A, Session Two
> T2: The difference is that ours is normal. So is someone is hypo that's hypo, what's the problem? Based on the definition she just used.

> Group A, Session Three
> T1: Did anyone use any other sources for these things besides the O'Sullivan's? Did anyone look in the nursing, the Fundamentals of Nursing?

> Group B, Session One
> T3:   Prior to that, Sorry (interrupted student). I was going to say prior to that about sentence about transferring to his son's home, what is before that?
> S2: Skilled nursing?
> T3: Do you know what the differences would be?

> Group B, Session Two
> T3: What I would suggest you do, however, is to relate these factors to the patient, so how is Erickson psychological development related this case, how is this biological development influenced by what we have on the page here? We know what to text book say, but what about this patient?

Questioning is a skill that tutors need time to develop. All tutors appeared skilled in asking thought-provoking questions. Tutors were able to use questions to challenge students to think more deeply and to assess their level of understanding. Tutors also used questions to

assess the group's understanding of a given topic. Tapes and transcripts indicated the tutors

asked questions in a non-threatening manner which resulted in the students' apparent willingness

to respond to the tutors' questioning. All of the above questions were appropriate and generated

thoughtful student responses. This type of interaction was apparent throughout all the group

sessions.

Verification

All tutors provided verbal support for their groups by offering encouraging remarks and

validating student comments.

> Group A, Session Three
> T1: Good Job Guys.

> Group A, Session Three
> T1: Hey, it's a start, at least you found something.

> Group A, Session Three
> S5: I was thinking about that, the incontinence in this case is due to the lack of reflex
> and we can sit there and have them do Kegel exercises until they turn blue in the face
> but they're not going to get that muscle activity until that reflex returns.
> T1: Your right.

> Group A, Session Two
> S2: Does there come a point….. no, that's not what I wanted to say, okay, other than a
> basilar which you said was very bad, can you have a bad enough stroke or a stroke
> that is so involved in so many different systems at such a high level that you really
> can't do anything? You do just go through the exercises and . .

> T2: Absolutely. That's why we're asking the questions.

> Group B, Session Three
> S2: You wanted us to make an Assessment Summary or something too didn't
> you?
> T3: Right. So when you are doing your evaluations, your evaluation statement will be
> that assessment of what you found, what you would do with the patient? Who you
> might refer to what were the impairments and so on.

Tutors appeared to have a healthy rapport with their groups in part evidenced by their constructive feedback. Listening to the tapes and reviewing transcripts made it clear that the tutors' had a genuine commitment to the students.

Perceived Role of Tutor: Student Perspective

Tutors are meant to function as facilitators of the group process. However, students may not understand the function of the tutor expect to act as a content expert. Students in the research groups appeared to understand that the tutor is a facilitator.

Facilitator

It is clear from the transcripts that tutors most often functioned as group facilitators. Students generally respected the tutors' position as a facilitator and seldom attempted to use them as content resources. However, as indicated earlier, there was one tutor who strayed from her role as a facilitator and acted as a content resource even though students did not ask for information. The same group of students had a second tutor, who did not provide excessive content information, nor did the students ask her for content information.

PBL literature indicates that students are more likely to try to use the tutor as a source of information to resolve learning issues if the appropriated sources such as, texts, content experts, lectures, labs, etc. are not available or they are inadequate. That does not appear to be the situation in this curriculum. During group meetings the students seldom used the tutor as an information source and they frequently mentioned sources of information such as text, personal experiences, didactic information from labs and lectures, internet sources, and journal articles. The following are just a few examples of the students' use of resources.

Group A, Session Two
S4: In Umfred, surgical removal of the clot and lowering the blood pressure to decrease hemorrhaging, mumbling, has not been helpful.

Group A, Session Two
S1: Um, it's in (reference) It goes, the title is Acute Stroke Rehab. It talks about general principles, um, pharmalogical therapy that could do. Then he gets into like the surgery . . . just, the surgery in a brief paragraph.

Group A, Session Three
T1: And where did you find it, what's your source?
S5: O'Sullivan's.
T1: What page in O'Sullivan's?
S5: Around 530.

Group B, Session Two
S5: Where's that from?
S2:   That is from O'Sullivan.

Group B, Session Two
T3: Where'd you get the book?
S2: Um, I'm thinking it's um Waxman.

Transcripts and tapes provided evidence that the students were use to giving resources to support their comments. Students often provided their resources with out prompting, but they were also quick to provide resources when asked to do so by the tutor or other students. The lack of hesitation to provide this information indicated to the researcher that the students knew this was an expected behavior in the group and came to the group prepared to provide their resources.

Perceived Role of the Student

According to the most widely used PBL model students are meant to run the PBL group process. Tutors help students learn how to function as a PBL group. This occurs over time, usually one semester. During this time, tutors relinquish more and more control of the group. By the time students are in their second semester, like the groups in this study, they are expected

to require little assistance from the tutor. Student roles include directing discussions, questioning

or challenging each others' statements, and being an active participant in the group process.

Directing Discussion

The students in both groups demonstrated that they were capable of running many

aspects of the group process with little tutor input. The following excerpts demonstrate the

students' ability to determine the direction for the discussion.

Group A, Session Two
S3: If we're going to do the exam first, I think we need to go back from like, I think we
     rushed through it too quickly. When we did systems, like, decreased sensation, I
     think we need to talk about, like, what sensation are decreased like, through the
     middle cerebral artery, you know, she's going to have um, like what patterns and stuff
     like, I know that weaknesses would be an upper extremity and um, fascia.

Group A, Session Two
S1: How long they can tolerate it, endurance. Write that down since we didn't get to
     cover it last time, depression instance, discharge planning, incontinence. I just
     needed those clarified because I was not sure if I made them up or . . .

Group A, Session Three
S1: Okay, where to next?
S4: What about the feeding tube? Can we do that first?

S1: Yeah, well that kind of goes with the safety factors issues so yeah.
     Go for it girl.

Group B, Session Three
S2: Want to do preventive? What else did we say, like the strengths,
     deficits, or [pause] the head control [pause] poor head control?

The few comments provided above are representative of students directing the group and

should not be interpretive as the extent of the students' group direction. Information collected

from the tapes and transcripts indicate that the students determined the flow of the discussion.

The groups apparently knew the group process well enough that they did not often need to

specifically address group process issues but they were capable of solving organizational glitches that arose during group meetings.

Questioning or Challenging

Students also appeared skilled and comfortable asking and answering questions of each other. This is the usual technique of sharing information within the group. Students are encouraged to challenge each other's information and receive challenges in a positive manner. With practice group members recognize the need to assess the quality of information, seek the appropriate level of information, and provide quality information. These characteristics of the PBL group process are seen in the following passages.

Group A, Session Two
S3: What were the ones you said after urine? You said urine and (interrupted)
S5: Um, blood analysis.
S3: Oh, it's right there, OK.

Group A, Session Two
S1: Decrease in cardiovascular endurance?
S5: Other endurance.
S3:   Is there other endurance?
S1:   Yeah, muscular skeletal, like strength wise you can't go.
S5: To maintain that strength over a period of time.
S1:   You have strengthen but, you just can't do a repetitive action. Just like when you're lifting if you're building endurance.

Group A, Session Three
S1: But why wouldn't you want them up like that all the time, because if you lower it, the risk of doing 45 degrees. O' Sullivan talked about aspiration.

Group B, Session Two
S1: So he can't see the right side, correct? I'm just making sure I have it in my head correctly. That that's what it meant.

Group B, Session Three
S5: Would right side neglect is that sort of the same as vision? Should that be a part of ,

like, safety factors and patient education and not really treatment? Just going back over
that (interrupted)
S3: I think it's going to be a problem because we're going to have to help them be
aware…like make sure that they're aware in all their training. Like transfers we're
going to have to be aware (Does not complete thought.)

Student discussions were energetic and filled with a free exchange of ideas. Students

appeared comfortable with the give and take of the Socratic process of the group meetings.

There was very little evidence of tension between group members as they engaged each other in

this dialectic process. The researcher believes this can be attributed to the groups' previous

group training and experience.

Participation in Discussion

Although all students participated there was a range of participation with some students

frequently contributing and a few students exhibiting a low frequency of participation (see Table

5). Group A had a larger discrepancy between student participation rates. The disparity in

student participation may be reflected by the lower ratings that students gave tutors for their

ability to bring all group members into the discussion.

Listening to the tapes provided some evidence that there were some group members who

were more hesitant to share their thoughts with the rest of the group. Some of these students had

quieter voices and sounded less sure of themselves when they spoke. There was no evidence

from the tapes or transcripts that these students' ideas or comments were not well accepted by the

group. It appeared that students who participated less did so because they chose to and not

because of barriers to participation created by the group.

Table 5

Student high and low percentages of group participation

Student	Session 1	Session 2	Session 3	Session 4
S1 (High)		15%		
S5 (Low)		5%		
S1 (High)			22%	
S6 (Low)			3%	
S2 (High)				27%
S6 (Low)				7%
Group B				
S1 (High)	9.8%			
S4 (Low)	6.6%			
S1 (High)		12%		
S4 (Low)		7%		
S5 (High)			14%	
S3 (Low)			9%	

Note. There is no data for session one for Group A because the group did not discuss the problem. There is no data for session four for Group B due to the poor quality of the audiotape of the meeting.

Effects of Context

The context in this case appeared to support group success. The Student Evaluation of Tutor, Self Assessment of Learning, and Group Evaluation showed that the students believed the groups functioned well and that they did learn. Overall they indicated that there were no problems with any of the group meetings. There did not appear to be evidence of any major disruptions in the group process. Groups seemed to work well even though there is evidence that tutor statements were higher than what is often seen in PBL groups. Student participation was fairly evenly distributed in Group B but in Group A one female had a much higher comment frequency than the other members of the group and the two male members had a consistently lower response rate. Tutor performance as rated by the students was acceptable and there was

little difference in the student ratings between tutors. Overall responses obtained from the

Student Evaluation of Tutor were positive, from which one can infer that the group meetings

were effective.

Student Evaluation of Tutors

The Student Evaluation of Tutor forms, which used a scale of 3 - 1, "highly effective",

"effective", and "not effective", respectively and "N/A", were supportive of the tutors

performance (see Tables 6 and 7) The highest ratings are listed in Table 6 and the items with the

most "not effective" responses and lowest rating are listed in Table 7.

Table 6

Student evaluation of tutor: highest scored items

Item	N^a	Minimum	Maximum	M	SD
Promoted problem solving behaviors: asked open-ended questions.	37	1	3	2.32	.580
Helped the group refine and distribute LI.	38	1	3	2.34	.534
Fostered critical thinking: used thought provoking questions.	37	1	3	2.35	.538
Promoted professionalism: modeled professional behavior.	37	1	3	2.35	.538
Fostered critical thinking: promoted integration of information.	35	2	3	2.37	.490
Handled introduction and set stage for the problem.	41	1	3	2.39	.542
Promoted problem solving behaviors: gave group members time to think before answering questions.	38	2	3	2.42	.500
Promoted professionalism: showed respect for group members.	36	2	3	2.44	.504

Note. N equals the number of responses per item for all sessions. Values below 44 result from responses marked N/A.

^{a}The maximum value of N = 44.

Ratings between tutors were similar but there were a few aberrations in student

responses. For example, several Group B students chose "N/A" as the response to several items,

particularly items related to learning issues, hypotheses, and plan. It appears that Group B's

ratings were more appropriate for these items than Group A's, since it was clear from the transcripts that the groups did not formally address these topics. Also, two students in Group A marked "highly effective" on most items for all sessions. It was also noted that one student in Group A had an unusually high number of "not effective" responses for the third session.

Table 7

Student evaluation of tutor: lowest scored items

Items	N[a]	Minimum	Maximum	M	SD
Fostered communication and interpersonal skills: brought all students into discussion.	33	1	3	2.03	.637
Facilitated effective use of time and resources: kept the group on track.	37	1	3	2.11	.567
Facilitated effective use of time and resources: helped group coordinated resources use.	34	1	3	2.12	.537
Modeled and facilitated responsibility: encouraged group members to be well prepared.	35	2	3	2.14	.355
Problem follow-up: had the group reassess action plan.	28	1	3	2.21	.499

Note. Values below 44 result from responses marked N/A. N equals the number of responses per item for all sessions.
[a]The maximum value of N = 44.

Tutors gave themselves lower ratings than the students gave them. Two tutors did not give themselves a score higher than "effective". One tutor rated herself/himself "highly effective" in several areas. This contradicts the following student responses related to her session. (Please note that in the following student responses students are identified by "S" only. Numbers were omitted because the following student responses cannot be related to the student transcripts.)

Group (omitted to protect identity)
S: I have a good bit of background in (omitted to protect identity), but since I had a (omitted to protect identity) today, I was (NOT) too prepared for class. Therefore what I learned in class is all I know about CVAs at the moment which is fine with me because I can read up on the thing I don't understand. Plus, I didn't pay too much attention because it was such an odd day with a tutor who does everything different

than 4 people in a group of 5. Therefore this is a very atypical meeting. Honestly not much is really confusing to me and I just need to prepare for next class.

Group (omitted to protect identity)
S: I knew some material prior but majority of the info was new material. Today I left class with not learning that much because we structured it a little different. Usually we do general information first but today we jumped into the exam. We left class without sharing information, or doing some objectives that I thought needed to be done.

Self Assessment of Learning

Results from the Student Self Evaluation of Learning questionnaire support the author's

interpretation that the groups were successful. The following student comments indicate that the

students felt that the group process supported the learning process.

Group A, Session Two
S: This class went well I felt I prepared well for it.

Group A, Session Four
S: This was a good meeting and typical.

Group B, Session Two
S: I felt comfortable with my own knowledge which was then reinforced by the group (everyone left feeling comfortable with what was discussed).

Group B, Session Three
S: Discussion helps me understand.

Group B, Session Three
S: I feel my understanding is on the same level as my groups.

Group B, Session Four
S: We all understand or we don't move on.

Group B, Session Four
S: I think our group is leaving with the same knowledge and understanding.
     Group B, Session Four
S: [the group] Helps clarify subjects and timing of stroke rehab.

The following selected examples are evidence that the students believed the group

process was effective.

>Group A, Session Two
>S: My understanding of the information enhances by group discussion and it also becomes cloudy at times but I usually clarify all info by the test. This stuff (info) becomes a part of you!

>Group A, Session Three
>S: For the most part I understand what we are discussing. Discussion always helps me clarify.

>Group A, Session Four
>S: We've covered this information in our other two classes therefore I was pretty well aware of most of the info. However, this class brings it all together.

Students provided evidence that the group process introduced them to new content,

content related to the problem, and the problem objectives. The following comments are

responses to the first guiding statement, *Information and concepts to which you had no previous*

exposure, on the Student Self Evaluation of Learning form.

>Group A, Session Two
>S: Anything pertaining to stroke is new to me, I have had little prior experience with strokes.

>Group A, Session Two
>S: CVA: management, treatment, diagnosis, risk factors

>Group A, Session Three
>S: Feeding tubes

>Group A, Session Three
>S: Dysarthria vs. expressive aphasia, NG tubes

>Group A, Session Three
>S: Feeding tubes which still remain confusing to me but I was guided as to where to look for the information. My group also gave me a good foundation to start my research.

Group A, Session Four
S: First degree, second degree, and third degree prevention

Students commented on what they had learned. The following selections are related to the stimulus statement: "Information and concepts which were familiar but the group helped you understand better".

Group A, Session Three
S: Apashia, dysarthria, homonymous heminopsia

Group A, Session Three
S: Incontinence, interventions of CVA

Group A, Session Four
S: Interventions, outcomes

Group B, Session Two
S: Skilled nursing facility

Group B, Session Two
S: Differential diagnosis of a stroke, medical management

Group B, Session Three
S: Medical terms that go along with stroke

Group B, Session Three
S: Sequel of events

Group B, Session Three
S: A-fib, exam

Group B, Session Four
S: Discharge criteria, goal setting, interventions

The next set of responses relate to the following statement: "Information that confirmed your understanding of a particular concept".

Group A, Session Three
S: Problem list, short term and long term goals, meds.

Group A, Session Four
S: Planning of treatment
Group A, Session Four
S: Safety factors and interventions

Group B, Session Two
S: Everything was basically reinforcing and applying my knowledge

Group B, Session Four
S: Discussion of stroke

Group B, Session Four
S: Discussion, asking question, talking about treatment

Group B, Session Four
S: Group work

Group B, Session Four
S: Discussion throughout

Group Evaluation

Responses from both groups to the Evaluation of the Group questionnaire indicated that

students generally valued the group process. Students were asked to use a Likert scale of 1 – 5

where 1 = "I strongly disagree" and 5 = "I strongly agree". Responses are presented in

Appendixes P and Q. With the exception of three students responses from both groups responses

to the "Student Self Evaluation of Learning" form demonstrate that the students liked the group

work and agree that it is important for learning.

The three students who were not satisfied with the group work were members of Group

A. Responses from one of these student indicated dissatisfaction with sessions three and four.

This student disagreed with "I was satisfied working in this group" and agreed with "Overall I do

not like group work". This student also gave a high rating to the presence of friction within the

group. The second student appeared dissatisfied with sessions two, three, and four. But, unlike,

the first student, he/she did not demonstrate a consistent pattern in their responses. For example, he/she rated liking group work low and rated all other aspects of group work high. A third student's responses were also inconsistent: he/she rated both "Overall I do not like group work" and "I was satisfied working in this group" as 5, "I strongly agree".

The other eight student responses were more supportive of the group process. Overall, students had positive comments about the PBL process. Students from the study groups and students not in the study but from an upper division class in the same program volunteered that they thought their PBL curriculum was better than the traditional curriculum of a nearby physical therapy school.

Conclusion

In conclusion the data showed that the PBL group process used in the study site curriculum was different than the most commonly used model, Barrow's model. Variations in the group process were noted in: (a) fact gathering, (b) hypothesis generation, (c) identification of learning issues, and (d) group planning. Whether these differences had an effect on student learning is unknown. Possible ramifications of this variation will be addressed in the discussion.

The context in which the group functioned appeared to support the group process. For example, at the time of the study both students and tutors had had training in the PBL group process, the department's philosophy statement supported PBL and the PBL group process, tutors and students appeared to have positive attitudes toward group work, and both students and tutors appeared to understand their roles in the group process.

Examination of tapes and transcripts also provided insight to the quality of the group process. It was evident that all members of the group were treated respectfully which

encouraged a safe atmosphere in which a free exchange of ideas could occur. Tutors and

students respected each other and appeared to work toward a common goal. In short the

researcher, who has experienced the PBL group process, was impressed with the group process

demonstrated by the tutors and students in this study.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

This chapter provides interpretation of the results of the study, the practice implications

of the study, and suggestions for future research. The interpretation of results is organized by the

two questions posed by the study. The author establishes the relevance of the study in the second

section, *Practice Implications*. This is done by organizing the section into populations that may

find the study's information useful and by providing a rationale for each population's interest.

Finally, the author speculates on the future of this line of inquiry.

Group Process

Question one asks "What happens in the PBL group process and does it reflect the

common belief of how a successful PBL group works?" The research groups did not conform to

the group process presented as the model PBL group process. The differences detected from the

transcriptions were: (a) groups did not generate formal hypotheses, (b) groups did not identify

individual or group learning issues during group meetings and (c) group sessions were not used

for gathering facts.

The model PBL group process begins with the generation of hypotheses about the

problem. Once hypotheses are generated, the group tests them during discussions throughout the

sessions and either confirms or disproves them. The purpose of this step is to stimulate critical

thinking and to encourage hypothetico-deductive reasoning skills. Critical thinking can occur

without this particular step but it is questionable whether the hypothetico-deductive reasoning

process occurs. Barrows (1998) believes that hypothesis generation is important in developing

clinical reasoning skills. It is known that novice clinicians use a hypothetico-deductive reasoning process. It is also known that when experienced clinicians face an unfamiliar clinical scenario they use hypothetico-deductive reasoning. Consequently, Barrows includes hypothesis-generation (see Appendix B) as a component in his model.

Even though the groups in this study showed critical thinking skills, and effectively worked their way through the problem as evidenced in the transcriptions, the absence of this step may have adversely affected their clinical reasoning skills. It is difficult to say if this was indeed the case. Some studies have shown that PBL medical students who used the model PBL group process outperformed medical students from non-PLB curricula in clinical reasoning skills. However, this performance difference, noted in the first year in the clinic, was negligible after the first year and not all studies found the same results. Some studies indicated that there are no differences in clinical skills between PBL and non-PLB trained clinicians. Also, it is difficult to show that when differences in clinical skills do exist, that the PBL trained clinicians' early advantage is related to the hypothesis generation practiced during group meetings. There is additional uncertainty in the case of physical therapy because to date no studies have examined the relationship of physical therapists' early clinical skills to PBL.

In addition to possibly missing the opportunity to practice early clinical deductive reasoning, the students may have missed the benefits of the metacognition associated with hypotheses generation. The sampled students did create hypotheses, as demonstrated in the transcripts, but without the formal recognition within the group that this was occurring. And, the group members may not have been aware of this learning technique.

The second absent component of the group process was the identification of individual and group learning issues. In the sample population, the students received the problem and the problem's objectives prior to their first group meeting. This action circumvented the need for the generation of LIs during the group meetings. In practice there are probably few disadvantages to this method since it allows the students to address the curriculum's content. However, without the formal generation of learning issues within the group students may have missed an opportunity to enhance their understanding of how they learn.

The third missing component of the model group process was the gathering of facts related to the problem. There are situations in many professions, including physical therapy, when the proper way to gather facts needs to be modeled and practiced. This can be done in PBL groups with problems that are meant to mimic a patient-clinician interaction. It is an effective way for students to learn how to interview a patient and to determine what information they need to treat effectively a patient.

The student's ability to gather information from patients is most likely unaffected by the lack of fact gathering during group meetings. This is because the students have opportunities outside the group that facilitate this skill. Students may learn this skill in resource sessions, labs, and during clinical experiences provided by the curriculum. Although students in the sample groups have a variety of ways of learning how to gather information, excluding it from the group process may result in another failed learning opportunity. In all PBL problems, not just clinical ones, the identification of additional information needed to address the problems helps develop critical thinking skills.

Even with these missing components, the group process used by the research groups allowed them to address the content and concepts of the curriculum. As shown by the transcriptions, the students demonstrated communication skills commensurate with the ability to give information, seek information, and work toward a common goal. Also, the functioning of the two sample groups appeared to be the same. For example, even with different tutors, group A's process remained the same from session to session and remained similar to group B's. The groups appeared to follow the method established by the department. Based on the researcher's experience with PBL groups, the researcher was impressed with the students' group process.

Interaction of Group Process and Context

The second question asks "How does the context in which PBL groups operate affect group function?"   This question examines the relationship of the groups to their environment. The major components of the context such as program philosophy, tutor and student training, and tutor and student roles were explained in previous chapters. This chapter will summarize the particular relationship between the sample groups and the context. Due to the small sample size, the results of this study do not allow the author to determine the relative amount of influence of each component.   The results of this study however indicated that the context did affect group process.

The first component, the philosophy of the department, clearly indicates the program's commitment to PBL. The department and the administration of the institution demonstrated this commitment. The sample program began its curriculum as problem-based with full support from the administration, which included financial support. The program director also noted that because the program was starting as a PBL curriculum all the faculty understood and wanted a

PBL curriculum. It appears that this level of support by the campus and departmental administration and the faculty is critical to the success of a PBL curriculum.

The department actualized its belief in the educational benefits of PBL by providing training for the faculty. All faculty members had access to training in PBL outside the department. One tutor reported that she was trained in the PBL group process at McMaster University. A second tutor reported that she had received training and still had access to additional training. The third tutor responded in a written survey that she did not have access to additional training but after speaking with the tutor she indicated that she had received extensive training and there was not much else available. This extent of faculty training requires both a philosophical and financial commitment to PBL by the institution.

The amount of student training was difficult to discern from the questionnaires. There were mixed responses: some students indicated that they had one to two hours of training, one student responded that he/she was trained during his/her application interview, and several students responded "N/A" when asked about group training. All students indicated that they had one semester of experience in PBL groups. It is clear from the transcripts that the students knew how to function in PBL groups. Based on the students' performance in groups and the common practice of training students during their first semester, it is a reasonable assumption that students were trained in the group process during their first semester. Students, like the tutors, appeared to be well trained in the PBL group process.

The roles of the tutors and the students are a third context factor. As seen in the analyses of data from the "Student Evaluation of the Group", "Student Evaluation of the Tutor" and "Tutor Self Evaluation", the student and tutor roles fit the roles defined in the model PBL

process. Tutors overall were facilitators and students were active participants in the group, often taking charge of the group process. It is assumed that these roles were established during the first semester.

There were occasions when tutors functioned as content resources, but this did not occur often enough to influence negatively the group process. Also, students did not routinely attempt to use the tutors as content resources. These two behaviors, evident from transcript evaluation, indicated that students and tutors knew the role of the tutor. It is the author's experience that the tutor's behavior greatly affects the group. When the tutor acts as a content resource, and not a facilitator, students have no need to provide or seek information from each other and the group process is lost.

The structure of the research site's curriculum also supports the roles of the tutor as facilitator. The students had ample content resources outside of the group. The literature indicates that when students do not have adequate resources they turn to the tutor for information. The sample curriculum provided students with support outside of the group session via concurrent lab and resource sessions that covered concepts related to the problem. (see Appendix O)

The program's philosophy, its support of tutor and student training, and the appropriately defined role of tutors and students created a context which supported not only the group process but also the entire PBL process. When this level of support is reached a culture of support develops. This level of support was present at the institution under study. Further evidence for this came from an unsolicited source, upper classmen, who stated that they believed PBL was the best way to learn. They stated that they thought their school was better than the other physical

therapy school in the state. This superior status was attributed to PBL. This kind of attitude from students and faculty promotes the success of the curriculum and the success of the group process.

The author used the students' comments about their group process and their comments about learning to test the above interpretation. Students indicated that they valued the group process, believed their groups worked well, and learned during their group meetings. The researcher found the students' comments supportive of the researcher's interpretation.

In conclusion, there is evidence that a relationship exists between the context and the sample population's group process and that a positive context fosters the group process. An accompanying assumption is that the absence of one or more of the sampled components or a poorly implemented component may negatively affect the group process.

Practice Implications

This study has practice implications for both problem-based learning and traditional curricula. Problem-based curricula can benefit from the design of this study since it can be implemented in other PBL curricula to assess the group process. The findings can provide valuable insight into curricula which have student, course, and curricular outcomes closely linked to the group process. The result of this study are pertinent to current and future PBL courses and curricula. Because group process is a critical component of curricular PBL, a better understanding of the group process will lead to an increased understanding of the effect of the group process on the overall curricular process and vice versa. Many of the educational outcomes of PBL are associated with the group process and determining the group process is primary to evaluating the educational benefits of the group and the curriculum. Also, this study

provides a means for examining the group process which is foundational to other studies of student groups and PBL.

Educators using traditional curricular paradigms may also find the structure and evaluation of the group process useful. The ability to examine the group is not only pertinent to those involved in PBL but to all educational environments that use student groups. In a time when education is being encouraged to move away from lecture-based instruction toward student-centered, and active learning this study presents an example of an educational process that facilitates both. Using the group process as a means of learning, whether associated with a PBL curriculum or a traditional curriculum, is one method of instututing needed educational reform.

This study is useful to a variety of populations including school and program administrators, curriculum designers, curriculum evaluators, students, and tutors. School and program administrators may use this information to help them develop, support, define and assess PBL. Curriculum evaluators may find this information useful in defining and assessing tutor/student groups, a major component of the PBL curricular process. PBL students and tutors may find some components of this study useful in evaluating the process and quality of their group sessions. All of these populations, regardless of their particular needs, require an accurate description of the PBL group process, and this study offers a method for analyzing PBL group process.

Implications for practice can be related to findings from the group process and the context. An accurate description of the group process will allow the above populations to assess the quality of their group process, compare groups within and between curricula, and assess

group outcomes within and between curricula. Presently, if a program states that it is PBL there is no way of knowing exactly what that means. For example, the APTA defined the PBL program used in this research as curricular problem-based. It is grouped with three other schools under the same title and definition. The sample population did not use the same group process as the widely used PBL format chosen as the model for this study. It is possible that if other programs were sampled there would be differences between the programs' group process and this PBL site and between the programs' group process and the model.

The information collected about the relationship of the context to the group process may be of use to academic administrators, faculty, and students. Understanding the connection between the context and the PBL group process may help academic administrators make financial and personnel decisions that support the PBL group process. For example, if an administrator recognizes the importance of properly trained tutors to the group process that administrator is more likely to allocate funding and make time available for tutor training. Information about the relationship between the context and the group process could result in an increased appreciation by faculty and students of the need for PBL group process training.

The populations most likely to find the results of this study useful include students, educators, curriculum and course designers, and educational administrators associated with PBL. It will also interest to educators not associated with PBL who are interested in using groups as an instructional method and who are interested in educational reform.

<div align="center">Limitations and Future Research</div>

The last section of this chapter deals with the potential for this kind of inquiry. It is divided into two parts: (a) issues in data collection and analysis and (b) future research.

Issues in Data Collection and Analysis

During the course of data gathering and interpretation of the data it became evident that these components of the study could be improved. Data collection could be improved with changes in questionnaires, recording equipment, and participant instructions. Data analysis of transcriptions could be made more efficient by refining coding categories. The response rate from the students was very good but changes in some of the forms could have improved the quality of student responses. There is evidence that a few students were not discriminating in marking their forms as indicated by very little change in rating between items. Also, group A students rated tutors on hypothesis and LI generation, activities that were not apparent on session recordings and were not, according to the director of the program, part of the group process. A possible cause for the students' responses could have resulted from not understanding some of the items and the length of the "Student Evaluation of the Tutor" form. An explanation of the form and a more concise form would likely provide the needed information and decrease the time burden on the students. This change could increase the quality of responses.

The student and tutor information forms had some redundant questions and some of the questions were difficult to understand. Questions related to level of training were difficult for both students and tutors to interpret. Students' responses indicated a wide range of PLB group training even though they all received the same amount of training.   Tutors seemed to have difficulty discriminating between training, prior experience and experience as a group leader. Rewording these items or removing some items may correct this problem.

Other problems with the data may be related to the lack of time to explain adequately the forms to the students. The original plan was to meet with tutors and students for about thirty

minutes to distribute the questionnaires, to discuss the questionnaires, and to answer questions. But, because of a class schedule change, due to a recent snow storm, the meeting was shortened. There was not enough time for a thorough introduction to the questionnaires. The form that seemed to be most affected by the lack of time was the "Student Self-assessment of Learning". Again, the return rate was excellent but the researcher anticipated richer explanations of learning. Some of the students answered the stimulus questions (see appendix F) with responses like, "yes", "no", "true", and "false" while others provided detailed responses. These short one word responses were adequate, but detailed responses from all the students would have been more useful. Although written instructions were provided on the form, a more detailed verbal explanation would likely result in improved responses. There is also the possibility that students had too many questionnaires to answer after each session and they therefore reduced their responses to one word as a time saving measure. Changing forms by decreasing the number of responses and taking more time to introduce the forms to the students would likely improve the data quality.

Data collection could be improved with better recording equipment that would produce recordings with clearer sound and better volume. An omni directional microphone instead of a unidirectional microphone would have significantly improved the recording quality. The equipment used in the study made it difficult to transcribe the audio-tapes, which resulted in additional time spent listening to and transcribing group meetings.

Another possible solution to the recording problem is to use audio-video equipment. One reason for not using audio-video for this study was to avoid disturbing the group process. However, audio-video equipment has been used in similar studies with no mentioned deleterious

effects. Also, video would make the identification of group members easier and could provide richer information about the interactions between group members. Recordings of the groups did not lead to the identification of tension or disharmony within the groups. But responses to the "Student Evaluation of the Group" such as the ones listed below indicated the groups were not absent of these problems.

> S: Individuals often get heated with lack of chance to adjust to the group's style of learning. PBL is not good for those who cannot adjust to a new environment.

> S: I don't feel like I learned anything new because I was one of the two (students) prepared. It's very frustrating when this happens.

> S: When you are one of three guys in a class of females the estrogen pisses me off once in a while so I tend to shut up and ignore the women folk.

Perhaps visual information of the group would have led to the detection of nonverbal behavior and group process issues that were not detected by the audio recordings.

The last recommendation for improving data collection is to personally manage the equipment. The loss of session four of Group B resulted from the researcher's not being present to set up the recording equipment.

Finally, data analysis could be facilitated by better use of coding software. As the researcher became familiar with QS N6 software the researcher recognized that there may be more efficient ways to code transcripts. One step in becoming more efficient would be to develop a more concise coding procedure for the group process. If an essential core of coding categories unique to the PBL group process were developed a researcher using those categories could be confident that they had captured the defining characteristics of the group process. Another way to improve the use of the software is to make better use of the search options built

into the software. This would reduce the amount of line-by-line coding used in the initial stages of transcript analysis for this study.

Future Research

This study's methodology and instruments have the potential of being used by researchers as a tool for assessing PBL groups. The methodology is reproducible and capable of being refined and streamlined to make it more efficient. The following are some research possibilities that would incorporate the methodology.

Research opportunities envisioned for both the PBL group process and the relationship of this process to the context. The first possibility is to design studies that can help refine the present method. This can be done by performing the same study with the before mentioned modifications. Once the method has been modified and tested, studies using a larger sample could be conducted to generate statistics that could be applied to populations beyond the sample population. A larger sample would also make it possible to determine the statistical relationship between the group process and the context.

Another variation is to assess the group process at different points in a PBL curriculum. This could be done by comparing a cohort in the first semester of a PBL program and again in the second semester. Data from such a study could be used to examine the development of a PBL group and determine what facilitates this development.

Further studies could focus on student, course, and curricular outcomes as related to the group process. Such studies could compare outcomes to the PBL group process in a program or compare the PBL group process and outcomes between programs. Knowing the actual group

process of the sample groups would allow researchers to make valid conclusion about outcomes related to the group process.

<div align="center">Conclusion</div>

This research shows that there is a need to examine in detail the PBL group process. To date there are only a few examples of research that have examined the PBL group process in the detail (Holen, 2000; Hemelo-Silver, 2003; Koshman, Glenn, & Conlee, 2000). No studies have examined the group process for the same purpose as this study: yet, understanding what is actually occurring in PBL groups seems to be basic to PBL research. Without knowing the PBL group process, it is not possible to draw legitimate conclusions about what affects the group, and what the group affects. And, without knowing the PBL group process, it is not possible to draw conclusions about the outcomes related to the group process, and in a PBL curriculum this includes every outcome associated with the curriculum.

This study has shown that variations from what may be considered the typical PBL group process were present in the study groups. Variations in the group process were noted in: (a) fact gathering, (b) hypothesis generation, (c) identification of learning issues, and (d) group planning. But, it was also noted that the groups functioned well and the students addressed the objectives of the problem and the student responses indicated that they believed that the group process promoted learning. Tapes and transcripts indicated the students were very engaged in the group process and that the groups provided a safe and stimulating environment for the free exchange of ideas. Both tutors and students appeared to be skilled group participants.

Both groups functioned in an almost identical manner with the exception of some minor difference in the way tutors carried out their roles as facilitators. But overall both groups

appeared very engaged in the group process. Both groups operated in an environment of acceptance and trust.

The researcher has attributed the apparent success of the group process in this study to the consistency between groups and a culture that supports and promotes the group process. This culture can be characterized by the belief from the administration, faculty and students that the group process is a critical part of the curriculum. This culture has been promoted by the context which consists of the educational philosophy of the program, faculty and student training in the PBL group process, faculty and students prior experience with the PBL group process, faculty and students' attitudes towards group work, and the perceived roles of the students and the tutors.

In conclusion it appears that the success of the group process is not limited to the implementation of a specified series of events that occur during a group meeting. The absence of various components of the group process may effect particular educational goals such as student metacognition but, as demonstrated by the research groups, the overall group process can survive without the inclusion of every component included in model PBL group process. Despite variances from the model, it was clear that the research groups were engaged in a dynamic learning experience.

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APPENDICES

Appendix A

Example of PBL Problem

John Richardson

You have been asked to evaluate and treat Mr. Richardson. He c/o of low back pain and pain into his right buttock present for 8 - 10 weeks. He has a past history of LBP.

1. Be prepared to debrief this patient.

2. Select the appropriate practice pattern/patterns for this patient.

3. Prepare a SOAP for this patient's first visit.

1. Examine and evaluate this patient and be able to justify both.

2. Identify possible P.T. diagnoses that may explain the patient's signs and symptoms and be able to describe and explain the patient's pathologies, impairments, functional limitations, and disabilities.

3. Based on the information obtained develop procedural interventions and be able to justify your choices.

4. Be able to describe the anatomy and biomechanics of the involved structures.

5. Be prepared to lead or participate in a discussion of the above areas.

6. Select the appropriate practice pattern/patterns for this patient.

Tutor Information

Learning Issues (objectives)

1. Communication issues: patient's use of alcohol with meds. and smoking habit, communication with other professionals in relationship to this patient, communication with family or significant others?

2. Lumbar examination and evaluation: what are the components of a lumbar exam, what is an efficient lumbar exam?
3. Lumbar special test: which ones are appropriate for this patient
4. Differential diagnosis: what are red flags for patients with these symptoms, what non-physical therapy generated information will you need to help you make a differential diagnosis, what and how do you rule out other pathologies? What other systems can produce back pain?
5. Chronic pain vs. Acute: what distinguishes one from the other, are the interventions different, are the prognoses different, what other professionals should be included in the treatment of chronic pain?
6. Disability questionnaires: what is a disability questionnaire, how reliable are these questionnaires, when are they used?
7. Drug, alcohol interactions: how do the medications that this patient is taking interact?
8. Effect of smoking Hx: what effect does smoking have on this patient's present problem and prognosis, and what effect does it have on his general health?
9. Intervention/s for this patient: establish and justify an intervention/s?
10. Prognosis: how long will this present episode last, how do you prevent future episodes?
11. Other health care providers: this patient has seen a Chiropractor: what is their training, licensure, scope of practice, relationship with P.T.?
12. Risk Factors: age, positions (sitting, standing, bent over), lifting (techniques, amount of weight), gender, time of day, general conditioning, body weight, work
13. Intradiscal pressure
14. Potential for reoccurrence
15. Psychosocial aspects of LBP
16. Practice Patterns: 4-B,D,E

CHART

Basic referral information	
1. Name	John Richardson
8. Age	38
9. Marital status	Single
10.Occupation	Truck driver for parcel delivery service
15. Referring physician	Frank Fredericks, MD--company physician
16. Diagnosis & Instructions to student	Evaluate and treat for low back pain. Document your findings and provide short-term and long-term goals with your treatment plan.
17. Physician's Assessment & Plan	Patient has lumbar pain with referral into R LE

| 1600 | Students' Task | Evaluate this patient for low back pain.
Determine assessment of his problem.
Determine appropriate goals and interventions. |

Medical History	
18. Chief Complaint	c/o pain in the low back and down into the R buttock.
2010 Hx of HEENT	Negative
2011 Hx of Cardiovascular system	Negative
2012 Hx of CNS	Negative
2013 Hx of GI tract	Negative
2014 Hx of GU system	Negative
2015 Hx of Pulmonary system	Patient smokes 1ppd x 20 years
2016 Hx of Musculoskeletal system	Has had periodic back pain for several years which has forced him to change jobs from loading and driving to more office work. Still drives occasionally as needed. Hx of rotator cuff tendonitis on the R shoulder approx. 4 years ago which flares up periodically.
2017 Past medical history	Essentially negative other than musculoskeletal complaints.

Lab Reports	
27. Hematology	None available
28. Imaging	Standard 3 view radiograph is essentially WNL.

Speak with…	
983 Physician	He has had several episodes of back pain before which got better with time. This one just seems to be a bit worse and has lasted longer. See what you can do for him to make him feel better.

HISTORY(PT Interview)

Current problem	
56. What brought you here?	My back has been hurting me a lot and I can't work with it the way it is.
57. Describe the injury	Eight weeks ago, I was on the road delivering parcels because the usual driver was sick. I had almost finished my run, which takes about eight hours, and went to reach for a small package that was on the floor beside me. While I was reaching for it, I felt sharp pain in my low back.
58. How did the problem begin	See: 57
59. What happened from then until now	After finishing the route, I went home and lay down on my back with a hot pack which has helped me before. When I

		tried to get up later, I was unable to straighten back up all the way because it hurt too much. The next day it was even worse and the pain even went down into the right side of my butt. I called up my chiropractor who has helped me in the past and went over to see him, that didn't help as much as it usually does. Went and saw the company doc and he told me to rest it for several days. It hasn't gotten much better so he told me to try physical therapy. It got a little better. I stopped going about three weeks ago. When I saw the doctor yesterday he told me to come to see you.
60.	Previous episodes?	Yeah, I have had some back problems before but never this bad. My back would get sore and if it got bad enough, I would use my heating pad and it would help or see my chiropractor and he would help it get better.
61.	Previous treatment	Previous chiropractic treatment before and I saw him 5X for this problem. I have also seen a physical therapist who used heat and traction. The chiropractor would shock me, use some kind of heat machine, then pop my back and that usually helped but did not last. The company doctor gave me some exercises that I have been trying to do but they hurt too much. (if asked--describe heat machine as an US, and exercises as Williams flexion exercises)
62.	Functional limitations	I can't stand completely straight. It hurts to lean over the sink in the morning to brush my teeth. I can't sit for too long because of the pain.
63.	Chief complaint	It hurts in my back and right cheek. I can't get into a comfortable position unless I am lying down. My back feels very tight and I am afraid to lift anything.
Pain		
64.	Where is the pain	Pain is in the lower part of the back and goes into my right cheek.
65.	Describe and grade the pain	When it is worst, it is a 8/10 - 9/10 level, this happens if I move the wrong way or try to pick something up. After lying down for awhile, it kind of quiets down to about a 5/10. It feels like a deep toothache that just won't go away.
66.	What makes it better	It feels a little better when I stand up and walk or lie down and rest. I feel more comfortable lying on my side or on my back with a pillow under my legs.
67.	What makes it worse	It gets really bad when I am sitting for too long--can't sit for more than 10-15 minutes at a time before I have to move around. It hurts when I go to the bathroom with a bowel movement. I don't know if it is just the sitting down or what bothers me at that time. It hurts a lot when I try to

		bend over to get dressed and shave at the sink. I have a hard time driving—can't drive the delivery truck and even have problems getting in and out of the car. It bothers me to go across town to come here to therapy.
68.	How is it at night	If I sleep right in the right position it feels better but I sometimes can't find a comfortable position. It wakes me up sometimes but if I can find the right position I can generally get back to sleep. The drugs the doc gave me have help with the pain, it never completely goes away, but they make me sleepy. I got a water bed but it doesn't help enough.
69	How is it in the morning	It depends on how I slept. If I was able to sleep it does not hurt that bad but I need to be careful about what I do and how I move.
70.	Reaction to position changes	I have a hard time moving quickly because of the pain. Standing up takes time before I get more comfortable even though it helps eventually.
71.	Cough and sneeze	Hurts worse with coughing and sneezing, it jerks my back.

Sensation		
1640	Do you have any abnormal sensations	It just hurts in my back and right side of my butt.
1641.	Describe the sensations & their intensity	NA

Medical Management (medications and other)		
88.	Medical investigations	The doc took some x-rays but said they didn't show any problems.
89.	Prescribed drugs	Vicoden
90.	Other prescribed drugs	None
91.	Over-the-counter medications	Tylenol
92.	Ever had surgery?	Just a hernia operation when I was a kid.
93.	Other treatment from doctor.	Have had some problems with my shoulder but that is doing well right now which is good. Don't know if I could stand having both problems at the same time.

Personal Health		
94.	Past illnesses	None
95.	Level of exercise	I play softball during the summer and some golf. Most of the

		time, I am too tired from work so just go home and crash.
96.	Diet	I eat pretty good, although I eat a lot of fast food. But I do try to get my veggies.
97.	Use of ETOH	Yeah, I drink some in the evening. I have 3 or 4 beers in the evening.
98.	Drug use	You kidding--they would fire me if I did. I have to take drug tests routinely.
99.	Health beliefs & practices	Traditional. Expects the docs and you to fix him.
	Tobacco use	1 pack/day X 20 years

Family		
100.	People in household	Single
101.	Children	Has two teenagers that stay with his ex-wife.
102.	Parents	Still living. Father had a heart attack 3 years ago but doing well.
103.	Siblings	Has an older sister.
104.	Significant others	Has a new girlfriend that he just met.
105.	Principal caregiver	Himself
106.	Health of family members.	Good

Work		
107.	What work do you do?	I tried to go back to work because I am afraid of being the next one to be laid off. When I went back I worked at parcel package center receiving department--getting packages from customers for delivery and getting packages for people who walk in.
108.	Describe job	I use to deliver packages by truck, they usually are not that heavy (around 50 to 70 lbs.) but sometimes kind of bulky. I always wore my back support — company policy. When I tried to go back to work I mostly weighed packages and checked the addresses. I had to lift some items but usually from the desk and not the floor.
109.	What do you do for leisure?	Play softball, drink beer and watch TV. Like to go fishing on the weekends. I have a new girl-friend.
110	Any avocational activities	Use to work on old cars.
111 Is the problem affecting work?		Definitely. Attempted to go back after the pain started but couldn't work because of the pain. Can't sit long enough to be useful. Can't get comfortable even standing. I can't lift. I want to try to go back to work so I can keep my job.
112 Is the problem affecting leisure?		Can't get comfortable sitting to watch TV, have to lie down on floor to watch. Affecting love life--(see below for

		his new girlfriend's ad which he responded to.) Wants to get back to being a cabana boy.
1121	Any problem with ADLS.	Hurts to get dressed and lean over sink.

PT Physical Examination

General Observations (whole person/body)		
200.	General appearance	Well developed, muscular, slightly overweight
201	Posture	Leans forward slightly, loss of lumbar lordosis, minimal fwd shoulders and head.
203	Alertness	Good
204	Nails/trophic changes	WNL
205	Heart rate	75 bpm
206	Blood pressure	130/90 mm Hg
Observation of spine (assumes pt undressed)		
113.	Overall symmetry	No lumbar step-off noted. Decreased lumbar lordosis.
114.	Bruising, wounds, scars	None noted
115.	Appearance of soft tissue	No abnormalities
116.	Standing posture (posterior)	No scoliosis no lateral shift.
117.	Standing posture (lateral)	Leans forward slightly--loss of lumbar lordosis.
118.	Pelvis	Equal bilaterally
119.	Leg length	Minimal difference noted
	Sitting posture	Slumped posture with forward head

Observation of L & R. UE (assumes pt undressed) Essentially WNL. Right shoulder depressed compared to L. No atrophy or scars noted.
Observation of L & R. LE (assumes pt undressed) Essentially WNL. No atrophy or scars noted.

Quick Screening Exams

Quick Screening Exam: Upper Body Not evaluated.		
Quick Screening Exam: Lower Body		
1133	Active and passive movements	Has significant limitation of forward flexion and extension. Deviates to right with forward flexion.
1134	Strength	WNL--no atrophy noted or significant weakness
1135	Sensation	WNL

PALPATE

L. Hip		
305	Surface temperature	WNL
306	Soft tissue	WNL

307	Muscle	WNL
308	Joint structures	WNL
309	Trigger points	WNL
R. Hip		
310	Surface temperature	WNL
311	Soft tissue	No atrophy noted
312	Muscle	No significant weakness noted.
313	Joint structures	WNL
314	Trigger points	Minimal tenderness noted over hip musculature including piriformis

Palpate Lumbar spine		
357	Surface temperature	WNL
358	Soft tissue	Some increased muscle tone noted over bilateral paraspinals esp. on the R side. If palpated, Quadratus lumborum muscle tender to palpate bilaterally.
360	Joint structures	Spinous processes in good alignment. No step-off noted.
361	Accessory joint movements	Decreased PA translation and pain over lower lumbar vertebrae esp. L5. Muscle guarding noted especially with spring test.
362	Trigger points	Painful to palpate lumbar musculature.
Palpate SIJoints		
363	Surface temperature	WNL
364	Soft tissue	Tenderness noted over musculature on sacrum and lumbosacral ligament.
367	Accessory joint movements	Negative for pain
368	Trigger points	

MOVE

Move Tx spine		
373	AROM	WNL
374	PROM	Not assessed
375	Resisted isometrics	Not assessed
376	Joint play	PA spring tests negative in lower thoracic spine
1413	Functional assessment	
Move Lx Spine		
377	AROM	Assessed in standing. Has significant limitation of forward flexion to approx. 30°, with lateral deviation to the right, and pain to right buttock. R lateral flexion limited by pain to 15°, L lateral flexion to

		10°, with some pain on R side. Repeated flexion in standing (FIS) produces pain at end range. Repeated (FIS) does not significantly affect symptoms, still pain at end range. Extension is limited to 30 degrees. Extension produces pain and tightness at end range at level of L5. Repeated flexion and extension do not result in increase in ROM. Right and left side gliding in standing (SGIS) are limited with pain. L (SGIS) < R (SGIS). Pain in low back at end range 7/10.
378	PROM	Assess in supine for flexion and prone for extension. Results are similar to AROM in standing.
379	Resisted isometrics	Resisted extension, and right and left rotation produce pain in low back 3/10. (pain subsides in approximately 3 minutes)
380	Joint play	Decreased movement in lumbar spine.
1414	Functional assessment	Has difficulty bending forward and sitting for 10- 15 minutes before he needs to stand. Did not attempt any lifting (floor to waste, waste to overhead, etc.) or carrying because of present symptoms.

Special Vertebral tests		
568	Quadrant tests	Has increased pain with R and L extension and flexion combined with lateral flexion. Worse with overpressure. Combined L lateral and forward flexion pain is > than combined R lateral and forward flexion pain.
573	Straight leg raise	Has increased pain, "like burning" on the R after 60° of SLR. Negative on L for pain although can only go to 75° due to tight hamstrings.
574	Kernig's sign	Positive Right
576	Hoover's sign	Normal
575	Prone, knee flexion	Negative
1777	Slump test	Positive with symptoms on the right
580	Side lying, compression	Negative
578	Iliac gapping test	Negative
579	Gillet test	Not assessed
581	Flexion tests for SI joint.	Not assessed
	Oswestry Disability Index	44%

Waddell signs

Superficial skin tenderness	Only tender with deep palpation
Deep tenderness	Positive over paraspinals
Axial loading	Negative
SLR—Flip sign	Has pain with attempted flexion of hip with knee straight both positions—consistent.
Abnormal neurological exam	Negative
Overreaction	Pain behavior with movement in all directions is very guarded. The patient tells you to be careful and groans when he has pain.

Left lower quadrant tests	
472 Thomas test	Decreased hip flexion noted bilaterally

NEURO MODULE

Sensory (general)

Trunk--sensation is WNL

LE: Light touch and sharp/dull are normal and equal bilaterally

Reflexes	
854 Quadriceps knee (patellar)	++
855 Gastroc-Soleus - Calcaneous	++

Superficial reflexes	
860 Babinski	Negative
Clonus	Negative

Appendix B

Outline of PBL Group Process from Barrows

I. The structure of teaching and learning sequences in problem-based learning

    A. The first time the group meets:
        1. Introductions and background of each member.
        2. Establishing the climate and ground rules.

    B. The first session
        1. Establish learning objectives.
        2. Evaluate and mange the problem, as far as possible, with the present knowledge and skills possessed by the group. The problem is taken on as an unknown without prior preparation.
            a. Develop information available at the outset.
            b. Generate multiple hypotheses as to the cause of the problems.
            c. Carry out an appropriate inquiry to attempt to establish the more likely causes.
            d. Analyze new data obtained through inquiry as it relates to the forming picture of the problem.
            e. Add the new data that is thought to be significant, particularly in light of the hypothesis obtained, to a growing problem synthesis.
            f. Continue this process, scanning for new information when stuck, creating new hypothesis as appropriate.
            g. Decide at an appropriate point, despite inadequate or confusing data, on the most logical cause and the appropriate treatment for the problem using criteria such as prevalence, seriousness ,and treatability.
        3. As the above process is going on, learning issues should be identified and recorded whenever knowledge or skills to understand appropriately or deal effectively with the problem are aspects of the problem are found to be lacking in the group.
        4. At the completion of the problem encounter, when the group who committed itself to the probable mechanisms responsible for the problem and its management, the areas of needed learning through self-directed study are identified.
        5. The appropriate resources for this learning are decided upon and allow the time required for self-directed learning before the group returns to the problem.

    C. Self-directed study is carried out by the individual members of the group for the time negotiated. During this, embers of the group may decide to work together and consult, but there is no formal group meeting.

D. Follow-up session, following self-directed study, to complete work with the problem.

    1. The learning resources use in self-study by each member of the group are critiqued and decisions are made about more appropriate resources in the future.

    2. The problem is encountered again from the beginning now that the group has learned all it thought it need to learn in the first encounter with the problem. Problem solving with new knowledge, applying what has been learned in self-directed study. The same stages are uses as in B2 (above). As this is done, the group critiques its prior thinking, Further learning issues may surface and a new self-directed study period may be necessary before the nest fe4w steps are undertaken.

    3. Conscious integration of new learning. The group verbalizes, systematizes and integrates the new information and skills gained.

    4. Evaluation of problem solving skill, self-directed study skills and group support skills of each student is carried out in the group. The evaluation of each student is initiated by the sudden himself.

II. The structure of the Tutor's teaching process.

    A. Modeling the performance expected of the students through example by the tutor himself or through close coaching by the tutor to produce the desired performance in the students.

    B. Guiding the students with challenges and comments at the metacognitive level.

    C. Withdraw from the group as the students begin to function effectively on their own, until the tutor is now longer necessary.

III. The structure of the group's interpersonal process.

    A. Initially, the students are courteous to each other and to the tutor and on their best behavior.

    B. Eventually conflicts in personalities, behaviors and opinions invariably become apparent and may detract from the groups' effectiveness.

    C. Conflict resolution is followed by effective, high output by the group.

Appendix C

Model of Group Process in Context

```
                    ┌─────────────────────────┐
                    │  Programs Educational   │
                    │      Philosophy         │
                    │ (Program characteristics)│
                    │   Archival Data and     │
                    │       Interview         │
                    └─────────────────────────┘
```

| Role of tutor Question 2 | | Role of Students Question 2 |

| Tutor training Question 2 | Quality of Problems (Controlled variable) | Student level of group function Question 2 |

| Tutor performance Question 2 | Group Process Question 1 | Student Performance Question 2 |

| Evaluation of Group Process Question 1 |

Note: "Question 1" and Question 2" denote the research question associated with the component listed in each box.

Appendix D

Student: Group Evaluation Form

Rate the following items on a scale of 1 - 5 where: 1 = "I strongly disagree." and 5 = "I strongly agree."

Please answer the following questions about your most recent group meeting.

1. I was satisfied working in this group.   1 2 3 4 5

2. There was a lot of friction in my group.   1 2 3 4 5

3. My group was effective in working with the problem.   1 2 3 4 5

4. There were a lot of differences of opinion in my group regarding   1 2 3 4 5
   this problem.

5. This meeting was characterized by open and effective communication   1 2 3 4 5
   among its members

6. There were frequent disagreements in my group about opinions   1 2 3 4 5
   regarding new information and concepts.

7. This was a useful meeting.   1 2 3 4 5

8. This group meeting was a typical meeting.   1 2 3 4 5

9. I learned something during this meeting.   1 2 3 4 5

Please answer the following general questions about how you group usually works.
(Do not answer these questions if have done so on a previous form.)

1. People in my group seldom argue about who should do what.   1 2 3 4 5

2. The members of this group challenge each others ideas without   1 2 3 4 5
   making the other person feel bad.

3. There are frequent disagreements about who should do what   1 2 3 4 5
   in my group.

4. My group performs well.   1 2 3 4 5

5. There is a lot of emotional conflict in my group.   1 2 3 4 5

6. My group's meetings help me identify what I know and don't know   1 2 3 4 5
   about a problem.

7. Overall I do not like group work.   1 2 3 4 5

8. Working in the group helps me decide what I need to study.   1 2 3 4 5

16. My group's meetings help me understand new information and concepts.   1 2 3 4 5

Appendix E

Student Evaluation of Tutor Form

BEGINNING THE TUTORIAL My Tutor:	Highly Effectively	Effectively	Not Effectively	N/A
handled introductions & set stage for the problem				
STARTING A NEW PROBLEM Encountering the problem				
facilitated students to develop objectives				
assisted the group to assign tasks (scribe, problem resource etc.)				
Reasoning through the problem				
encouraged brainstorming				
facilitated development & documentation of				
hypotheses				
learning issues and facts				
action plans				
group learning objectives				
helped the group refine & distribute learning issues				
encouraged group to identify appropriate resources				
PROBLEM FOLLOW-UP My Tutor:				
facilitated an effective critique of resources				
got students to summarize the problem from memory				
had the group reassess each of the following as the case developed:				
hypotheses				
learning issues and facts				
action plan				
group learning objectives				
PROCESS ISSUES &GENERIC ABILITIES My Tutor:	Highly Effectively	Effectively	Not Effectively	N/A
Fostered critical thinking				
Used thought provoking questions				
Challenged students statements				
Promoted integration of information				
Promoted clarification of concepts and terms				
Introduced new wrinkles to stimulate learning				
Facilitated effective use of time and resources				
Kept the group on track				
Helped group coordinate resource use				

PROCESS ISSUES &GENERIC ABILITIES My Tutor:	Highly Effectively	Effectively	Not Effectively	N/A
Fostered communication & interpersonal skills				
Modeled clear and appropriate communication				
Encouraged give and take interchange among group				
Brought all students into the discussion				
Provided positive constructive feedback				
Modeled non-judgmental behaviors				
Modeled and facilitated responsibility within group				
Carried through with needed group function tasks				
Prepared for the tutorial				
Encouraged groups members to be well prepared				
Promoted professionalism				
Modeled professional behavior				
Showed respect for group members				
Facilitated effective critique of resources				
Promoted problem solving behaviors				
Asked open-ended questions				
Gave group members time to think before answering questions				
Challenged the group to see & integrate relationships among facts, processes, & concepts.				

Comments regarding your/your tutor's strengths and suggestions for change.

Appendix F

Student: Self Evaluation of Learning Form

Please use this form to record what you **just** learned in your group meeting. Give thorough

descriptions in as much detail as possible.

As you perform this activity please consider the following areas but remember that you are not

limited to information related to these areas. Please read all the following before you begin to

write.

1. Information and concepts to which you had no previous exposure.

2. Information and concepts which were familiar and which the group meeting helped

    you understand better.

3. Information that confirmed your understand of a particular concept.

4. Information and concepts that remains confusing.

5. Your understanding of topics brought up in the group compared to other group members

    understand of the same topics.

Appendix G

Tutor: Self Evaluation Form

BEGINNING THE TUTORIAL	Highly Effectively	Effectively	Not Effectively	N/A
I handled introductions & set stage for the problem				
STARTING A NEW PROBLEM Encountering the problem				
facilitated students to develop objectives				
assisted the group to assign tasks (scribe, problem resource etc.)				
Reasoning through the problem				
encouraged brainstorming				
facilitated development & documentation of				
hypotheses				
learning issues and facts				
action plans				
group learning objectives				
helped the group refine & distribute learning issues				
encouraged group to identify appropriate resources				
PROBLEM FOLLOW-UP I / My Tutor:				
facilitated an effective critique of resources				
got students to summarize the problem from memory				
had the group reassess each of the following as the case developed:				
hypotheses				
learning issues and facts				
action plan				
group learning objectives				
PROCESS ISSUES &GENERIC ABILITIES I / My Tutor:	Highly Effectively	Effectively	Not Effectively	N/A
Fostered critical thinking				
Used thought provoking questions				
Challenged students statements				
Promoted integration of information				
Promoted clarification of concepts and terms				
Introduced new wrinkles to stimulate learning				
Facilitated effective use of time and resources				
Kept the group on track				
Helped group coordinate resource use				

PROCESS ISSUES &GENERIC ABILITIES I / My Tutor:	Highly Effectively	Effectively	Not Effectively	N/A
Fostered communication & interpersonal skills				
Modeled clear and appropriate communication				
Encouraged give and take interchange among group				
Brought all students into the discussion				
Provided positive constructive feedback				
Modeled non-judgmental behaviors				
Modeled and facilitated responsibility within group				
Carried through with needed group function tasks				
Prepared for the tutorial				
Encouraged groups members to be well prepared				
Promoted professionalism				
Modeled professional behavior				
Showed respect for group members				
Facilitated effective critique of resources				
Promoted problem solving behaviors				
Asked open-ended questions				
Gave group members time to think before answering questions				
Challenged the group to see & integrate relationships among facts, processes, & concepts.				
Comments regarding your/your tutor's strengths and suggestions for change.				

Appendix H

Coding Template Developed For Coding Transcripts of Group Meetings

(1)	Base Data
(1 1)	Base Data/Group data
(1 1 1)	/Base Data/Group data/score on exam
(1 1 2)	/Base Data/Group data/Number of LI
(1 2)	Base Data/Individual data
(1 2 1)	/Base Data/Individual data/gender
(1 2 1 1)	/Base Data/Individual data/gender/female
(1 2 2)	/Base Data/Individual data/MB type
(1 2 3)	/Base Data/Individual data/score on exam
(1 2 4)	/Base Data/Individual data/group #
(2)	On task activity
(2 1)	On task activity/Questions patient database
(2 2)	On task activity/content
(2 2 1)	On task activity/content/biofeedback & Estim
(2 2 2)	On task activity/content/risk factors
(2 2 3)	/On task activity/content/interventions
(2 2 4)	/On task activity/content/types of incontinence
(2 3)	On task activity/identifies learning issue
(2 3 1)	/On task activity/identifies learning issue/biofeedback & Estim
(2 3 2)	On task activity/identifies learning issue/causes of incontinence
(2 3 3)	On task activity/identifies learning issue/interventions
(2 3 4)	/On task activity/identifies learning issue/types of incontinence
(2 4)	On task activity/response from patient inquiry materials
(2 5)	On task activity/summarization
(2 6)	On task activity/hypotheses
(2 6 1)	On task activity/hypotheses/S I U
(2 6 2)	On task activity/hypotheses/past pregnancy
(2 6 3)	On task activity/hypotheses/lax pelvic floor
(2 6 4)	On task activity/hypotheses/sphincter insufficiency
(2 6 5)	On task activity/hypotheses/recent problem
(2 6 6)	On task activity/hypotheses/menupause
(2 7)	On task activity/info sharing
(2 8)	On task activity/reinforcement
(3)	Process
(3 1)	Process/PBL process
(3 2)	Process/Technical issues
(3 3)	Process/getting lost

(3 4)	Process/dissatisfaction
(3 5)	Process/resources
(3 6)	Process/guidance during tutorial
(3 6 1)	Process/guidance during tutorial/direction
(3 6 2)	Process/guidance during tutorial/redirection
(3 6 3)	Process/guidance during tutorial/challenges
(3 7)	Process/organization
(3 7 1)	Process/organization/assignments of duties
(3 7 1 1)	Process/organization/assignments of duties/volunteered
(3 7 1 2)	Process/organization/assignments of duties/shared
(3 7 1 3)	Process/organization/assignments of duties/appointed
(3 7 2)	Process/organization/arrival time
(3 7 2 1)	Process/organization/arrival time/early
(3 7 2 2)	Process/organization/arrival time/late
(3 7 3)	Process/organization/departure time
(3 7 3 1)	Process/organization/departure time/early
(3 7 3 2)	Process/organization/departure time/late
(3 7 4)	Process/organization/recorder
(3 7 5)	Process/organization/organizational ploy
(3 7 6)	Process/organization/future meetings
(4)	Off task activity
(4 1)	Off task activity/socialization
(4 2)	Off task activity/sarcasm
(4 3)	Off task activity/trivia

Q.S.R. NUD.IST Power version, revision 4.0.

Appendix I

Individual General Information Form

Group Number: ___
Date: _____

1. Age: _____

2. Gender: F __, M ___

STUDENT ONLY

3. Approximate amount of training for the group process prior to becoming a group member:
   None __ , 2 hours ____, 4 hours ____, 6 hours _____, more _____

4. Prior experience as a member of a PBL group: # of semesters/quarters ____

5. Number of group sessions devoted to learning the group process. _____

6. Have you ever functioned as the leader (tutor) of the group? Y __ N ___
   (If you answered "Y" yes continue on to the next set of questions.)

TUTOR (GROUP LEADER) ONLY

7. Level of PBL group leadership abilities:
        novice___, average___, expert ____

8. Level of understanding of content related to this problem:
        minimal ____, average ___, content expert ____

9. Approximate amount of group leader (tutor) training prior to becoming a group tutor. None
    ___, 1 - 2 hrs __ , ½ day ___ , whole day ___, 2- 3 days ____, more ____

10. Is training beyond your initial training made available to you? Y___ N ___

11. (Only answer this question if you answered yes to #6.) How much additional training have
    you received? _____

12. Prior experience as a member of a PBL group: # of semesters/quarters ____

13. Number of group sessions devoted to learning the group process. _____

Appendix J

School Philosophy

THE CURRICULUM
Introduction to Problem-Based Learning
The problem-based learning model was selected for this curriculum because of its capacity for establishing a systematic clinical decision-making pattern, promoting development of skills in teamwork, developing student skills in critical analysis, and transmitting professional knowledge, skills and attitudes. The model stresses the process of learning as well as the content of learning.

These abilities are important to the practice of physical therapy today, and will be even more important as reflective practitioners in the profession guide its adaptation to the information explosion, managed care models, health care and information technologies and other changes in health care delivery.

Problem-based learning is well suited to a graduate program because of its emphasis on adult learning models and student responsibility for learning and other behaviors, because it facilitates sharing the diverse educational and experiential backgrounds of students and faculty members, and because it promotes use of a variety of learning styles. Problem-based learning is student-centered, focusing on learning rather than on teaching. Student responsibility for identifying a need for information, locating and evaluating information, and assessing the performance of themselves and others is central to this approach

The mission and philosophy statements of the Physical Therapy Department, curriculum objectives, and competencies expected of graduates are provided to promote student understanding of the curriculum design.

Mission and Philosophy
Mission Statement
The purpose of the Department of Physical Therapy at [name removed] embraces the [name removed] tradition of service to others, leadership, and excellence in education in preparing the physical therapist as a generalist who is able to practice with interdependence in a variety of settings including areas underserved by the health care system, such as rural and inner city locations. The physical therapist will be prepared to deliver physical therapy services with populations diverse in age, gender, culture, marital status, ethnicity, language, psychosocial, educational economic status.

Revised November 1997

Philosophy Statement

      The faculty supports the departmental mission statement and interprets it as follows:

      We believe that as a basic right, all members of society are entitled to access to health care. Anyone served by the health care system has a right to participate in personal health care decisions; this right may need to be protected by health care professionals.

      Awareness of economic, ethical, and social constraints has affected the rate of change in delivery of and reimbursement for health care. Changes in the health care system also have been influenced by the information explosion and the continuing development of technology.

      Physical therapy can be defined as
. . . the assessment, evaluation, treatment, and prevention of physical disability, movement dysfunction, and pain resulting from injury, disease, disability, or other health related conditions.

      The profession of physical therapy is a health science and therefore physical therapists are responsible for contributing to and disseminating the knowledge base that advances the delivery of health care services. The physical therapist is a health scientist who embodies the characteristics of a professional. The role of the physical therapist includes providing patient care, teaching, supervising, managing, administering, advocating, consulting, learning, investigating, collaborating, publishing, and giving oral presentations.

      The education for the practice of physical therapy is best provided at the post baccalaureate degree leave. The educational environment must support learning and inquiry, and provide challenges for learner and faculty, and promote collegiality between faculty and learner.

      Adequate physical facilities should be available, ensure the welfare and safety of faculty, learners and staff, and promote their productivity. The learning environment is enhanced by a faculty complement sufficient in qualifications and size to encourage development and exchange of ideas, collaboration in research, teaching, and other scholarly activities and participation in institution, professional and community service including clinical practice

      The faulty serve as role models in the institution and in the public and professional communities. The faculty are active participants in advancing, discovering, and sharing new knowledge.

      The foundation of professional education is the humanities, natural, biological, behavioral and social sciences, mathematics, and communications skills. Learning occurs best when the learner integrates currently held values, knowledge, abilities and skills with the new values, information and skills. Practice of newly acquired values and skills is necessary to this integration. Learners in physical therapy are adults who are intelligent, able, and responsible for

their own learning. They are committed to acquisition of the knowledge, and skills required to practice with interdependence as a physical therapist.

The graduate will have the necessary knowledge, skills, attitudes and values to function with interdependence as a generalist in physical therapy. The graduate will be active in the profession and the community, contribute to the advancement of the profession, advocate for the welfare of the public and the profession, and be a continuing learner

Revised November 1997

Curriculum Objectives

The graduate will be able to:
1. Practice with interdependence as a clinician generalist in a variety of settings with populations diverse in age, gender, marital status, culture, ethnicity, language, psychological, educational and economic status.
2. Communicate nonverbally, orally, and in writing with others in language and style that is adapted to the audience .
3. Teach health care consumers, providers, and students the essentials of health care including prevention.
4. Participate in the advancement of the profession through service, research and other scholarly activity in collaboration with peers and colleagues
5. Apply the principles of administration and consultation in a practice environment
6. Participate in the creation of systematic change in health care and other areas that benefit the public welfare by working cooperatively with professional, community and governmental agencies, colleagues, and the public
7. Participate in a planned program for personal and professional growth

Revised November 1997

Appendix K

Human Subjects Consent Form

I _____ agree to take part in a research study titled "Group Process in the Context of a Problem-based Learning Curriculum" which is being conducted by (Thomas L. Stec, Institute of Higher Education at UGA, (706) 721-1517 or (803) 642-6724) under the direction of (Dr. Libby Morris, Institute of Higher Education, (706) 542-0580). I understand that I do not have to take part in this study; and I can stop taking part at any time without giving any reason, and without penalty. I can ask to have information related to me returned to me, removed from the research records, or destroyed.

The purpose of this study is to examine group process in a specific educational setting known as a problem-based learning (PBL) curriculum. By doing this the researcher hopes to gain insight about how PBL groups actually function and what components of the curriculum and the group itself contribute to the way they work. PBL group work is critical to the success and function of the whole PBL curriculum. A better understanding of the PBL group process will allow students, educators, and administrators to develop ways of monitoring, and improving PBL group.

I will not benefit directly from this research. However, my participation in this research may lead to information that could provide future students, faculty, and administrators with information that can be used to develop, monitor, modify PBL group function and ultimately effect PBL curriclums. Since the sample size for this study is small and there are several variables a case study method will be used, thus the results will not be generalizable to a population. This study is designed to discover information about the group process.

If I volunteer to take part in this study, I will be asked to do the following things:

1. I will be asked to participate as a member of a PBL group for the duration of one problem. I understand that this could be one to two weeks.
2. I will meet with the researcher and other participants for an introduction to the study. During this time the researcher will explain the questionnaires and other written materials. During this meeting I will be asked to fill out questionnaires designed to collect demographic information, determine my experience with PBL, and determine my opinion about the PBL group process. This will require approximately a half hour of my time.
3. I, along with the other members of my group, will be audio taped during scheduled PBL group meetings for one problem. This means that as many as three consecutive group meetings will be audio taped. During this time neither I nor anyone else in my group will interact with the investigator although the investigator may be present. These meetings can last from one to two hours but I understand that as a member of my group I would normally attend these meetings and thus this is not additional time related to the study.

4. At the end of each PBL group session I will be asked to respond to written questions related to what I learned during that session and a questionnaire related to group function. This should take no more than a half hour per session and I will most likely attend two to three PBL group meetings during this study. I understand that answering these questions will require 1 1/2 to 3 hours of my time over one to two week period.
5. I understand that the investigator may ask me and/or other members of my group to fill out additional forms or answer additional questions based on the first results of the study. This may take a ½ of my time, would occur only once, and could take place as long as 12 weeks after I have completed the first series of questions.

I will experience no more discomfort or stress than is related to my normal daily activities.

Participating in this study will not be exposed any more risks than I would experience during my normal daily routine.

All information concerning me will be kept confidential. If information about me is published, it will be written in a way that I cannot be recognized. However, I also understand that research records may be obtained by court order. The researcher will have little need to document my name or link my name to a specific group. Under most circumstances the only identification necessary is the number of the session, my assigned group letter (A,B, C, etc.) and a "code number" a three digit randomly generated and randomly assigned number. If my name is recorded during audiotaping it will remain on the audio tape and the transcription of that tape. The only other person who will have access to the data is a transcpitionist who will have no means of associating my voice with any other personal information such as the name or location of my school, my age, or my appearance. The transciptionist will also be told that all the data is meant to be confidential. In the event that I am quoted in the published reports I will be given a fictitious name. The school will not be identified by name in any literature nor will any references to location of the school be made. I also understand that I have the right to review/edit the audiotapes. Transcripts used for educational purposes will be edited so that my name does appear in the transcripts. All audiotapes will be erased within one year following the study.

Please note that this study has been approved by the Institutional Review Boards at the University of Georgia and Wheeling Jesuit University.

The researcher will answer any further questions about the research, now or during the course of the project, and can be reached by telephone at: (Thomas L. Stec, Institute of Higher Education at UGA, (706) 721-1517 or (803) 642-6724) or (Dr. Libby Morris, Institute of Higher Education, (706) 542-0580).
If they have any questions about their rights as

My signature below indicates that the researchers have answered all of my questions to my satisfaction and that I consent to volunteer for this study. I have been given a copy of this form.

_____   _____   _____
Name of Researcher   Signature of Researcher   Date
Phone: (706) 721-1517 Work
         (803) 642-6724 Home
Email: tstec@mail.mcg.edu

_____   _____   _____
Name of Participant   Signature of Participant   Date

Additional questions or problems regarding your rights as a research participant should be addressed to Chris A. Joseph, Ph.D. Human Subjects Office, University of Georgia, 606A Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu or Dr. Debbie Pollard, Ph.D., Chair of the Institutional Review Board at Wheeling Jesuit University at (304)243-2342, E-Mail Address dpollard@wju.edu.

Appendix L

PBL Problem Used by Study Groups

CASE 12 - MR. HWA YUAN

Mr. Yuan is a 67-year-old Asian male referred to physical therapy for examination and treatment of R hemiparesis secondary to a L MCA infarct that he experienced 2 days ago. He is currently in ICU awaiting a visit from a nursing liaison representative from the local rehabilitation hospital who will evaluate his rehabilitation potential. If he is denied inpatient rehabilitation, Mr. Yuan will be evaluated for appropriateness of a transfer to a skilled nursing unit. Transfer to his son's home in Taiwan is another option.

He retired 2 years ago from his job as a chef. He has enjoyed gardening, card games with his friends, and occasional visits from his son and 4 grandchildren. His wife died last year after a lengthy battle with breast cancer. He has numerous connections in this community, having lived and worked here since immigrating to the US from Taiwan at age 21.   He does not wish to return to Taiwan where his son resides

CASE 12 – MR. HWA YUAN – PAGE TWO

Your examination of Mr. Yuan reveals the following:

Patient is lethargic and oriented to self only. HR is 88I and BP is 180/100 on Nitrol paste

patches. EKG shows a-fib at 2/min. He is receiving continuous feedings through an NG tube

with a volumetric pump. Records indicate he is 5'10" tall and weighs 280#. He is incontinent of

bowel and bladder. Speech is dysarthric; patient attempts to verbalize when spoken to, but is

unable to complete words and becomes quickly frustrated by his inability to do so. Mr. Yuan

does not make eye contact when approached from the R side of the bed and he demonstrates R

side neglect. Visual testing, per his chart, revealed a R homonymous hemianopsia and R

conjugate gaze paralysis.

Limb reflexes are 2+. Sensory testing is equivocal secondary to communication

difficulty, but appears impaired throughout R UE and R LE. Strength testing is as follows:

	R UE	L UE		R LE	L LE
Shoulder	2/5	5/5	Hip	3+/5	5/5
Elbow	2/5	5/5	Knee	3/5	5/5
Wrist	1/5	5/5	Ankle	3/5	5/5
Hand	1/5	5/5			

Patient initiates rolling using his L LE, but is unable to complete the motion. Head control is

very poor when he is assisted to roll, and when assisted to sitting at edge of bed, patient's head

sags and trunk control is poor even with L UE propping. Standing and transfers were not

attempted, although patient indicated he wished to ambulate.

Appendix M

Equipment Information

The following materials list has been included to assist others who may be interested in using similar qualitative methods. Items 1 – 4 are the various materials used to record and transcribe the group meetings. I found all the recorders reliable and relatively inexpensive. The Panasonic transcriber is highly rated and one of the least expensive models available. I chose item number 5, QSR N6, for qualitative analysis over other similar programs because I had used an earlier version of it in another study. Because of this previous experience I knew that the program was appropriate for this study. I chose item number 6, SPSS, for quantitative data analysis because it is widely used, I already had the software and I have used it in the past.

1. 2 - Sony TCM-20DV portable tape machines

2. 2 - Radio Shack 33-3014 battery powered omni directional microphones

3. 1 - Radio Shack CTR-117 desktop cassette recorder

4. 1 - Panasonic RR-830 standard cassette transcriber

5. QSR N6 software for qualitative data analysis

6. SPSS statistical software

Appendix N

PBL Problem Case 12 Mr. Hwa Yuan

Tutor's Guide and Objectives

CASE 12 - HWA YUAN - TUTOR'S GUIDE
Preferred Practice Pattern: 5D
    Foundational Science: neuroanatomy of the brain, Pathology of stroke, Pharmacology
Behavioral Science: Care-giver management

Page One Objectives:

12.1.1. Describe the etiology of a stroke. (2*)
              Ischemia vs infarct. Discuss Circle of Willis

12.1.2. Discuss differential diagnosis of the case. (4*)
              (plegia vs paresis, tumor, TIA, seizures)

12.1.3. Describe the pathophysiology after a stroke. (2*)
              (Circle of Willis, differences between R and L lesions)

12.1.4.   Compare the arteriosclerotic process occurring in a patient with stroke versus an MI
              (4*)

12.1.5. Describe the medical management of an acute CVA. (2*)
              *(Dx tests: MRI, CT scan, cerebral angiography, carotid Doppler, ECG, EKG, echoc, PET
              Include discussion of TPA, given in first 3 hours. Surgery: Carotid endarterectomy,
              angioplasty)*

12.1.6. Describe the expected patterns of motor behavior and clinical status based on the
              (MCA) location of the lesion. (4*) *(differences between R – spatial problems,
              impulsivity, safety issues - and L – communication, expressive or receptive aphasia &
              reading -brain lesions, Brocca's area, recovery time, edema resolution, etc.)*

12.1.7. Plan and sequence a client examination including history, systems review and Physical
              Therapy Tests and Measures for this case. Identify the relevant data. (5*)

12.1.8. Discuss the implications of cultural, socioeconomic and ethnicity issues involved in this
              case on the treatment of this client. (5*)

12.1.9. Discuss the age related biological and psychological developmental tasks that would be
              expected of this patient. (5*)

12.1.10. Discuss the difference between acute IP rehab and SNF. (5*) *(criteria)*
(Include discussion of Risk factors – modifiable/unmodifiable)

CASE 12 – PAGE TWO – Tutorial Objectives

12.2.1. Correlate the patient's clinical findings with functional deficits. (4[*])
(Homonomous hemianopsia – 26%, conjugate gaze paralysis - horizontal mostly, DTRs)

12.2.2. Clarify the range of a PT's role in evaluation and treatment of the patient's vital functions (respiration, digestion, elimination) (4[*])
incontinence

12.2.3. Assess the impact of the communication and swallowing difficulties this patient is experiencing. (5[*])
Pump/NG or J tubes
See O'S & S pps.1005 – 2003 for dysarthria, aphasia & other common d/o

12.2.4. Describe the classification of the medications taken by this patient/client its actions and side effects and how this affects treatment (5*)

12.2.5. Synthesize the evaluation, diagnosis and prognosis from the information provided. Discuss what other information would be needed to complete this process. (5*)

12.2.6. Develop a prioritized problem list for this patient. (6*)

12.2.7. Describe the plan of care including the long and short-term goals with functional outcomes (5*).

12.2.8. Plan the interventions to reach the goals stated including indirect and direct interventions as appropriate. (5*)

12.2.9. Discuss patient/family/health care provider roles in and the timing of D/C planning. (4[*])

12.2.10. Predict this patient's rehabilitation potential. (5[*])
sPrognosis as in 12.1.5.

12.2.11. Predict how the patient's disability and limited D/C options might affect his emotional health. (5[*])

12.2.12. Project the impact on the family of the patient's son if the patient moves to his home. (5[*])

12.2.13. Discuss primary (general health), secondary (decrease duration of illness), and tertiary (limit/degree of disability), prevention measures for this patient. (5)

12.2.14. Discuss the expected outcomes and criteria for discharge of the patient/client from different levels of care (5*).<u>Criteria</u>: medical stability, tolerance for tx (3 hours/day), Cognition & ability to learn, Need for skilled services, Able to tolerate sitting up in w/c for one hour at a time, Motivation

12.2.15. Discuss the incidence of depression among patients with CVA. (5*)
(include emotional lability and behavioral changes)

12.2.16. Discuss the safety issues in this patient's plan of care and P.T. interventions. (5*)

12.2.17. Identify the Preferred Practice Pattern that best describes this patient. (5*)
(5D)

Appendix O

Example of Courses

Movement Science II (Tutorial)	Basic Science II	Physical Therapy Science II	Professional Issues II
	Diabetes Mellitus; Risk Factors; Pharmacology; Energy Transport and Storage; Nutrition; Extent of System Impairment and How It Occurs.	**ONE PAGE ABSTRACT DUE**; Trunk Stability, Balance and Coordination Progressions and Precautions, Rhythmic Stabilization	Educational Outcomes Evaluation
Case #12 Mr. Hwa Yuan MEQ		Peripheral Vascular Evaluation, Peripheral Neuro Eval., Interpretation of EMG / NCV Studies, Patient/Family Ed. (Foot care, etc.)	Documentation of Educational Outcomes; Project papers due
Week 9			
Case #12 continued; MEG	QUIZ; Kidney Function, Vision Evaluation, Exercise & Glucose Metabolism/glycogen Storage; Complications of Long-Term Chronic Diseases	MEQ; AFO & Foot Orthoses, Flaccid, Assisted ?; Footwear Adaptation; Compensation for Sensory Impairment, Foot Massage; Fluctuating Edema	Project Presentations

Appendix P

Student evaluation of the group: Group A

Item	N[a]	Minimum	Maximum	M	SD
I was satisfied working in this group.	23	1.00	5.00	3.7826	1.24157
My group was effective in working with the problem	23	1.00	5.00	3.8261	1.26678
This was a useful meeting.	23	1.00	5.00	3.6957	1.42812
This group meeting was a typical meeting.	23	1.00	5.00	3.5217	1.47308
I learned something during this meeting.	23	1.00	5.00	4.1739	1.15413
My group performs well.	23	1.00	5.00	3.8261	.98406
My group's meetings help me identify what I know and don't know	23	1.00	5.00	3.8696	1.17954
Overall I do not like group work.	23	1.00	5.00	2.2174	1.34693
Working in the group helps me decide what I need to study.	23	1.00	5.00	3.8696	1.17954

My group's meetings help me understand new information	23	1.00	5.00	3.8696	1.14035
There was a lot of friction in my group.	23	1.00	5.00	2.2174	.99802
My group was effective in working with the problem	23	1.00	5.00	3.8261	1.26678
There were a lot of differences of opinion in my group regarding	23	1.00	5.00	2.7391	1.17618
There were frequent disagreements in my group about opinions	23	1.00	5.00	2.8261	1.07247
People in my group seldom argue about who should do what	23	1.00	5.00	3.4348	1.44052
The members of this group challenge each others ideas without	23	1.00	5.00	3.5652	1.19947
There are frequent disagreements about who should do what	23	1.00	5.00	2.0870	1.12464
There is a lot of emotional conflict in my group.	23	1.00	5.00	2.7826	1.12640

Note. N equals the number of Group A student responses for all sessions.

[a]The maximum value of N for Group A is 24.

Appendix Q

Student evaluation of the group: Group B

Item	N[a]	Minimum	Maximum	M	SD
I was satisfied working in this group.	20	3.00	5.00	4.5500	.60481
My group was effective in working with the problem.	20	3.00	5.00	4.1000	.64072
This meeting was characterized by open and effective communication.	20	2.00	5.00	4.3000	.73270
This was a useful meeting.	20	3.00	5.00	4.4000	.68056
This group meeting was a typical meeting.	20	1.00	5.00	3.7000	1.03110
I learned something during this meeting.	20	2.00	5.00	4.2500	.85070
My group performs well.	20	3.00	5.00	4.1000	.64072
My group's meetings help me identify what I know and don't know.	20	3.00	5.00	4.2500	.71635
Overall I do not like group work.	20	1.00	4.00	2.0000	1.16980
Working in the group helps me decide what I need to study.	20	3.00	5.00	4.2000	.83351
My group's meetings help me understand new information.	20	3.00	5.00	4.2500	.78640
There was a lot of friction in my group.	20	1.00	4.00	1.9000	.96791

My group was effective in working with the problem.	20	3.00	5.00	4.1000	.64072
There were a lot of differences of opinion in my group regarding.	20	1.00	4.00	2.3000	1.08094
There were frequent disagreements in my group about opinions.	20	1.00	4.00	2.1500	.93330
People in my group seldom argue about who should do what.	20	1.00	5.00	3.6000	1.04630
The members of this group challenge each others ideas without	20	2.00	5.00	4.0500	.82558
There are frequent disagreements about who should do what.	20	1.00	5.00	2.3500	1.30888
There is a lot of emotional conflict in my group.	20	1.00	3.00	1.8500	.81273

Note. N equals the number of Group A student responses for all sessions.

[a]The maximum value of N for this Group B is 20.