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STUDENT PERCEPTIONS AND PERFORMANCE IN THE FIRST YEAR OF A
MIXED PHYSICAL THERAPY CURRICULUM

By

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Dissertation

Submitted to the Department of Leadership and Counseling

Eastern Michigan University

In partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

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December 6, 2005

Ypsilanti, Michigan

DEDICATION

This dissertation and the time, energy, and work that have gone into it are dedicated to my wonderful family. Without my husband, Dave, and children, Lindsay and Matthew, I would not have had the fortitude to complete this work. They have been supportive, kind, inspirational, and understanding throughout this prolonged process when I have been less available and busier than they deserved.

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I owe a heartfelt thanks to my committee chair, Chuck Achilles, who has guided me through the dissertation process from start to finish. He has persisted through many drafts and renditions with skill, humor, and diligence.

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ABSTRACT

Background: Physical Therapy (PT) is a dynamic health profession. There is a compelling need to educate physical therapists to become self-directed, lifelong learners capable of thinking critically. Mixed-design curricula utilize various teaching methods to instruct students in a variety of knowledge areas, psychomotor skills, and cognitive constructs, such as problem-solving, reflection, and critical thinking (CT).

Purpose: To describe outcomes for PT students enrolled in the first year of the mixed design curriculum at Grand Valley State University (GVSU). Outcomes included the development of self-directed learning (SDL) and CT, as well as student-described satisfaction with and perceptions of the first year of the curriculum.

Intervention: The Watson-Glaser Critical Thinking Appraisal (WGCTA) and The Self-Directed Learning Readiness Scale for adults (SDLRS-A) were used to assess students (n = 41) at the beginning of the GVSU PT curriculum. At the completion of their first year, the students retook the WGCTA and the SDLRS-A, completed questionnaires, and participated in structured focus groups. Differences between administrations of the WGCTA and SDLRS-A were statistically analyzed. Questionnaires and focus group data were used to assess students' perceptions regarding their perceptions of the first year in the GVSU PT curriculum.

Research Design: Mixed-method, cross-sectional, explanatory field study.

Conclusions: WGCTA pre- and posttest means demonstrated a statistically significant difference ($p = .05$), and SDLRS-A pre- and posttest means approached a statistically significant difference ($p = .06$). The 1-point difference in CT scores represents little-to-no practical improvement in CT. The negative 4.63-point difference in SDL scores indicated

poorer performance. End-of-course evaluation scores were most positive for a lecture and case-based course and least positive for a problem-based learning course.

Students described lecture and hands-on laboratory as the most effective methods for their learning and PBL-based instruction as least effective. Students described lecture, memorization, and hands-on laboratories as experiences matching their learning styles.

Students' perceptions of the first-year GVSU PT curriculum were that it was high volume, which caused them anxiety and stress. They expressed preference for clear, organized content presented in traditional formats and discomfort with PBL and unstructured, self-directed learning experiences. Students valued guidance, feedback, and applied content from instructors.

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CHAPTER 1: INTRODUCTION

Physical Therapy (PT) is a dynamic, evolving health profession. Changes in delivery of care or practice methods within the PT field occur in response to legislation, societal trends, consumer demands, evolving technology, and emerging research evidence. Changes in today's healthcare environment can lead to practitioners' knowledge's becoming obsolete over short periods of time. There is a compelling need to educate professional physical therapists (PTs) to become self-directed, lifelong learners (McGinty, 2000). PTs need to be continually willing to seek out, critically evaluate, and apply new information and knowledge to clinical decision making and problem solving in everyday professional encounters.

Many states (N = 38, in 2005) have legislation that allows therapists, as primary providers of rehabilitative care, some form of direct access to patients. Legislation is pending in the State of Michigan to allow PTs to practice autonomously. Because PTs are increasingly providing care in a direct-access capacity, they must know how to make reasoned diagnoses based on sound clinical judgments (McGinty, 2000). Whether in autonomous practice or in practice by referral, PTs must perform many tasks that are described in *The Guide to Physical Therapist Practice* (American Physical Therapy Association, 2001):

1. Provide services to patients and clients who have impairments, functional limitations, disabilities, or changes in physical function and health status resulting from injury, disease, or other causes.
2. Interact and practice in collaboration with a variety of professionals.
3. Address risk.

4. Provide prevention and promote health, wellness, and fitness services.
5. Consult, educate, engage in critical inquiry, and administrate.
6. Direct and supervise the physical therapy service, including support personnel. (pp. 39-40)

To fulfill their wide variety of practice roles and to adapt to the environment of independent practice, PTs of the future must be critical thinkers and problem solvers who are knowledgeable, reflective, self-directed learners. How to produce these valuable attributes remains controversial.

The necessity for excellent, responsive PT education places great demands on those whose role it is to educate professional PTs. Several possible curricular models exist for PT education, including those labeled traditional, problem-based, and mixed-design. In a traditional curriculum, long-established didactic methods, such as lecture, discussion, and structured labs predominate.

In a problem-based curriculum, the content is delivered entirely by an instructional method known as problem-based learning (PBL), characterized by the use of patient problems structured into cases that are used as the context for acquiring basic science and clinical knowledge and developing problem-solving skills (Barrows, 1985).

Finally, a mixed-design curriculum combines the two previous approaches and progressively moves from more traditional methods of instruction to more advanced methods, such as case-based, problem-based and seminar-based approaches. Several authors suggest that using PBL provides benefits to students that are different than those obtained from traditional instructional methods and curricula (Albanese & Mitchell, 1993; Royeen, 1995; Saarinen-Rahiika & Binkley, 1998; Baker, 2000). Educational and

behavioral outcomes attributed to PBL include (a) improved self-directed learning (SDL), (b) improved critical thinking (CT), and (c) improved ability to solve problems. PT educators pose questions about the success of various methods used for delivery of content during the educational training of PTs. Is any method superior to another for knowledge assimilation or retention? Is there an optimal time during the educational process when transition from more traditional to less traditional methods should occur? Educators also seek to understand whether any method is better than another in the development of the desired characteristics of PTs.

The Grand Valley State University (GVSU) PT program faculty use the mixed-design curricular approach for education of their students. The GVSU PT program is a three-year professional program culminating in a Master of Science degree in PT. Initially, courses using traditional methods, such as lecture, discussion, and laboratories, are taught. These methods are familiar to students from previous educational experiences. Traditional methods with emphasis on content mastery provide the factual knowledge base for upcoming courses and the development of problem-solving and critical-thinking skills. During the second semester of the first year, nontraditional methods are introduced. PBL and case-based learning are utilized in several courses to glean factual and contextual information as well as to promote psychomotor skill development. As the curriculum continues toward completion, greater importance is given to PBL, SDL, and seminar methods with the emphasis on assimilation, synthesis, and integration of knowledge. Concurrently, far less traditional lecturing and emphasis on factual memorization occurs.

In light of increasing use of alternate methodologies and curricular restructuring within the GVSU-PT program, it is timely to investigate the outcomes of the mixed-design approach for delivering curricular content. Because authors in the health professions urge careful scrutiny of the PBL approach within individual disciplines (Biley & Smith, 1998; Saarinen-Rikaala & Binkley, 1998; Jefferson, 2001), research conducted on PT students that addresses development of CT and SDL skills and perceptions of the educational process may assist and guide PT educators in assessment of PBL and mixed curricular designs.

Statement of the Problem

Often, educational innovations are adopted or adapted without careful scrutiny of their merits. Many PT preparatory programs are modifying their curricula to promote interactive, self-directed, problem-oriented, and life-long learning. Much has been written about the potential benefits of PBL for medical students (Patel, Groen, & Norman, 1991; Coles, 1990; Barrows, 1985; Schmidt, 1983) and student nurses (Magnussen, Ishida, & Itano, 2000). However, little is known about the outcomes of the PBL process for PT students, even as a method used within a mixed-design curriculum. There is a gap in knowledge about outcomes of mixed-method delivery of content in PT education. Leaders in PT professional education must actively examine all educational methodologies and curricular designs and then evaluate them for their merit. The lack of evidence supporting any PT curricular design is a serious problem that warrants further investigation.

Significance of the Problem

Despite the popularity of PBL as an instructional method in other health-professional and medical curricula, the use of PBL within a mixed-design curriculum in the education of PTs has not been well researched. If there are strengths or weaknesses attributable to PBL within a mixed curricular design, it is important to be aware of them. Nandi, Chan, Chan, and Chan (2000) suggested that although PBL is a newer curriculum delivery process, some combination of conventional and PBL instruction may provide the most effective training for medical students. Therefore, study of the mixed-design curriculum used by the GVSU PT program that includes both PBL and other traditional methods is important. The effectiveness of the GVSU PT curriculum in the development of critical thinking and self-directed learning skills is unknown and should be investigated. Likewise, the student perceptions of and satisfaction with the mixed-design curriculum remain undescribed and should therefore be studied.

Purpose of the Study

The researcher's purpose for this study was to investigate and describe outcomes for PT students enrolled in the first year of the mixed curricular design PT program at GVSU. Outcomes to be assessed included development of both SDL and CT measured by standardized tests, descriptions of student satisfaction measured by end-of-course evaluations, and students' perceptions of and satisfaction with their learning, as assessed through written and oral responses to questions.

Research Questions

Several research questions guided the investigation and comparison of outcomes related to SDL, CT, and perceptions related to the first instructional year for PT students

enrolled in the GVSU PT program. The study involved both quantitative and qualitative methods, which will be further discussed in the next section. The following questions are the basis for this research:

1. What is the difference in students' critical thinking skills between when they enter the GVSU-PT program and when they complete their first year of instruction?
2. What is the difference in students' perceptions of self-directed learning readiness between when they enter the GVSU-PT program and when they complete their first year of instruction?
3. What is the difference in end-of-course evaluation scores related to teaching methods (i.e., responses to items #16, #18, #20, #21, #23, and #34 on the course evaluations) between courses described as lecture, case-based or discussion and those described as PBL? (Refer to Appendix A for designations of courses within the first-year PT curriculum.)
4. Which modes/methods of instruction do students indicate as being most effective or comfortable?
5. Which modes/methods of instruction do students indicate as being least effective or comfortable?
6. What learning experiences do first-year PT students describe as matching their learning styles?
7. What perceptions about learning in their first year of the GVSU-PT program do the students describe?
8. What are the students' perceptions of and comfort with the types of teaching/learning used in the GVSU mixed curricular design?

Mixed-Method Approach, Design, Instruments, and Methods

This project was a cross-sectional, explanatory field study (Johnson, 2001). The study design entailed use of a cohort of PT students admitted to the GVSU PT program who were studied throughout their first year in the curriculum (See Appendix A for coursework in the first-year PT curriculum). Because this study used standardized, objective measures for the pre- and posttests, as well as questionnaires, end-of-course evaluations, and focus groups for data collection, it should be described as a mixed-method paradigm (Johnson & Onwuegbuzie, 2004). This mixed-method action research used both quantitative and qualitative measures and was performed on a convenience sample of students recruited from the researcher's own institution.

The first quantitative test used to gather data for this study was the Self-Directed Learning Readiness Scale for Adults (SDLRS-A). The SDLRS-A (A denotes the adult version), developed by Guglielmino at the University of Georgia (1978), has been widely used in dissertation research, including research on students in health professions (Walker, 2001; Linares, 1999). Guglielmino's (2000) most recent report stated that the SDLRS-A is the most widely used instrument for the assessment of readiness for SDL. Students' readiness for SDL was quantitatively assessed through a comparison of SDLRS-A pre- and posttests scores.

Another quantitative method of assessment was the Watson-Glaser Critical Thinking Appraisal (WGCTA). First published in 1942, the WGCTA has a long history of use in studies performed in educational settings. It was chosen for this study because it has established normative values and includes many validation studies, some performed with students studying health professions (Slaughter, Brown, Gardner, & Perritt, 1989;

Wilson, 2000). Several forms exist, including the original Form A and Form S. Form S, derived from Form A, is a shorter, more quickly administered (about 30 minutes), updated version of the WGCTA. Most analyses have been performed on Form A although equivalence between Form S and the longer Form A is acceptable (Ivens, 1998). Reported overall reliability (coefficient alpha) is .81 for both internal consistency and test-retest reliability (Geisinger, 1998). In the current study, students' CT was quantitatively assessed through comparison of WGCTA pre- and posttests scores.

SDLRS-A and WGCTA data were collected twice during the first year of the curriculum. Both tests were administered initially within the first two weeks of the program (pretest), and after completion of the third semester (posttest). The total instructional time in the first year of the GVSU PT program was approximately 42 weeks of classroom instruction and four weeks of clinical instruction. Clinical instruction in the context of the GVSU PT program is accomplished by placements in local area PT settings, where learning is guided by a clinical instructor (a licensed PT) but ultimately supervised and structured by the GVSU clinical education faculty.

Students' perceptions about coursework within the first curricular year were quantitatively assessed by examination of numerical scores on end-of-course evaluations. The results of end-of-semester course evaluations for all PT courses in semesters one and two were compared between GVSU PT courses that were offered in traditional methods and those that were offered in PBL or case-based methods. End-of-course evaluations for Health Science and Psychology courses offered in the first curricular year were not examined in the comparison because there were students from other programs enrolled in

the courses who could not be compared directly to the PT student cohort being examined in this study.

Students' responses to and perceptions about their first year in the GVSU PT curriculum were qualitatively assessed through the use of several methods. An additional, written questionnaire (Appendix B) was distributed with the end-of-course evaluations for all PT courses in the second semester of the curriculum. Structured focus groups of 8-12 students were conducted after third-semester courses to elicit verbatim responses to open-ended questions designed to answer research questions and triangulate data from the questionnaires (Appendix C).

SPSS Version 12.0 was utilized to statistically analyze data to determine differences between pre-and posttest scores on the SDLRS-A and the WGCTA. Course evaluations, questionnaires, and focus group transcripts were quantitatively analyzed with the use of numeric data on appropriate questions (between PBL and traditional classes) and qualitatively for satisfaction questions that were nonnumeric. The focus group sessions were audio taped and transcribed. Transcribed data were managed, sorted, and analyzed, with the assistance of a trained qualitative researcher, to discover themes and trends.

Strengths of the Study

This study had several strengths. The researcher studied students in an established, successful PT curriculum that uses a hybrid or mixed curricular design. All students in a single PT class (PT class of 2006) were studied throughout their first year in the professional curriculum. Internal consistency was provided because the coursework encountered by students in their first year is standard and presented in a prescribed order

(Appendix A). All PT students took the same courses throughout the first year of a *lock-step* curriculum and thereby could be assessed for their collective experience. A lock-step curriculum is one that proceeds in a prescribed order, and students are only allowed to progress when they have been successful in all previous courses. Quantitative and qualitative assessments in the study reflect an entire year of PT instruction during which PBL and other methods were introduced to all students and used within a mixed-curriculum design.

Tests of SDL and CT with established validity and reliability were used (addressed further in chapter 2). However, validity and reliability estimates for the WGCTA were established for the general population and not specifically for PT students. This may limit the assumption that the WGCTA is valid and reliable for the population used in this study. Guglielmino's dissertation (1978) reported the reliability estimate as .87. Construct validity for the SDLRS-A has been established (Brockett & Hiemstra, 1991). These assessment tools appear to be satisfactory for studying PT students' CT and SDL readiness during the first year of a mixed curriculum.

Standard end-of-course evaluations, additional questions, and focus groups were used to assess learner perceptions and satisfaction. The additional questions for learner satisfaction and perceptions were developed with the assistance of a qualitative researcher and were piloted on PT students who were not in the present study prior to the actual use of the questions for this study. Assistance with the development of questions and conducting of a small pilot study provided content validity for the questionnaire used throughout this study.

Finally, use of a mixed-method approach for this research had several advantages. The use of standardized quantitative tests of CT and SDL readiness allowed for statistical analysis using numerical data. The qualitative component allowed the researcher to better explore the perceptions and feelings of the students who participated in the research. Together, the statistical analysis and the qualitative analysis provided keen insight into the perceptions and performance of this group of students.

Delimitations of the Study

A delimitation of the study is that it examined students after the first year in a three-year PT curriculum. The first year of the GVSU PT curriculum is when traditional educational methods, PBL, and other methods are used either separately or in combination. After the first year, the curriculum uses fewer lectures and progressively more discussion, seminar, case-based, and PBL methods of instruction. Therefore, although the first curricular year should be the one of greatest change, it does not represent changes that may occur throughout the entire three-year PT curriculum.

In the present study, the PT courses in the first year of the GVSU PT curriculum were chosen for inclusion in the present research. All end-of-course evaluations for PT courses were examined, and the additional questionnaire was piloted during the first semester and given after all second-semester PT courses. Courses offered by other departments included students, such as physician-assistant students, who were not enrolled in the PT curriculum and who might have confounded end-of-course quantitative data.

PT student subjects were asked to rate all PT courses objectively, using end-of-course evaluations, but were not questioned about the individual instructors within the

first year. Student satisfaction with a particular course may have been influenced by the performance or personality of the instructor.

Another delimitation of the current study is that it examines the GVSU PT class of 2006. These students cannot be assumed to be similar to or dissimilar to any other class of PT students that have preceded them or will come after them. Likewise, the GVSU PT class of 2006 is not a representative sample of all PT students throughout the world.

Finally, a delimitation of the current study exists in the choice made by the researcher to study the outcomes of CT and SDL. With examination of only these two outcome measures, the complete impact of the first year of the mixed-design curriculum used by GVSU PT program might be missed.

Limitations of the Study

Use of a convenience sample without a control group is a design weakness. However, in this type of cross-sectional explanatory research using an entire intact group, a true control group was not possible. Demographic data (gender, age, and whether participants hold a bachelor's degree upon entry into the program) were reported for the PT class of 2006 and compared to data for two previous PT classes (2004 and 2005) to ensure similarity of groups across the years of the GVSU PT program. It is possible that the demographic characteristics of this sample are not consistent with those of other classes of students in the GVSU PT program or do not represent a larger population of all PT students throughout the United States who will graduate in 2006.

The use of standardized tests also presents potential limitations for this study. Unfortunately, no perfect or specifically designed test for measuring critical thinking and

self-directed learning behaviors in PT students exists. Tests of CT and SDL should be sensitive enough to detect change in learners over one year of a curriculum. On the basis of statistics supplied with the WGCTA test manual (Watson & Glaser, 1980), a critical change value of four points can be calculated. Wilson (2000) reported that meaningful gains, as measured by the WGCTA, were observed in only one of eight longitudinal studies performed on health professions students. Another undesirable effect that could occur is the ceiling effect “in which most of the scores from a sample are grouped near the top of the available range” (p. 29). Data from the study performed by Wilson suggested that a ceiling effect existed when another test of critical thinking (The California Critical Thinking Appraisal) designed for the general population was used with PT students. Using the WGCTA with the population in this study may create such a ceiling effect. The application of results of standardized, general CT assessments to PT students is difficult because of the lack of standard criteria for defining and measuring clinical PT competence in CT (Wilson, 2000).

Although the SDLRS-A has been used with several studies of health professionals and health professions students (Walker, 2001; Linares, 1999; O’Kell, 1988; Box, 1982), no critical change values have been calculated for it. This standardized test was constructed for use with a wide variety of learners and does not address specific self-directed learning behaviors considered important for PT students. It is, however, the most commonly used tool for assessment of self-directed learning readiness.

To assess the satisfaction and perceptions of PT students in the first year of the curriculum, end-of-course evaluations and responses on the additional questionnaire were used from each PT course. Selected questions from standard end-of-course evaluations

were used to infer satisfaction with PT courses within the first year. Because different instructors teach first-year courses, these evaluations represent data from multiple instructors. Although specifically designated questions were compared between courses, differences in satisfaction among courses may not be exclusively attributable to teaching methodology. Rather, satisfaction in any given course may be instructor or content related.

Finally, there is no way to know if students gave complete and accurate feedback on end-of-course evaluations. Only the bubble-sheet portion of the end-of-course evaluations was used by the researcher to examine satisfaction with PT courses; no verbatim comments were used. Students may not always place importance on completion of end-of-course evaluations; therefore, they may not have taken time to complete them accurately and completely. Because end-of-course evaluations use a standardized form common to the entire university, it is possible that questions regarding satisfaction chosen for analysis did not represent topics that would provide accurate feedback for the research questions being investigated by this study. One method employed to counter these potential gaps in student information was the use of focus groups to elicit more in-depth information about perceptions of and satisfaction with the first-year courses in the GVSU PT curriculum.

Importance of Findings to Research and Practice

The findings of this research will add to the literature base about mixed curricular designs and the development of desired traits (SDL and CT) in PT students as a result of their education. The findings will also add to the literature on student satisfaction with teaching/learning methods through comparison of classes taught with more traditional

methods to those taught in a PBL format. Additionally, the results may help the GVSU PT program faculty to make logical, informed decisions about methodology utilization and curricular changes. As the development of the clinical doctorate (DPT) in PT proceeds, exploration of curriculum, course content, and methods for information delivery is critical.

Organization of the Study

In this study, the researcher examined the effects of the first year of a mixed-design PT curriculum that included both nontraditional and traditional instructional methods on students' development of CT and SDL as measured by quantitative tests. Numerical scores on end-of-course evaluations and questionnaires were used to quantitatively examine satisfaction with instruction as well. This study also examined the students' perceptions of and feelings about their learning experiences within the first year of the curriculum.

An exhaustive review of existing literature related to the investigation is presented in chapter 2 of this study. The literature is subdivided into distinct sections, including (a) conceptual framework; (b) research traditions and philosophies; (c) physical therapy education; (d) historical overview of PBL, including CT and SDL; (e) teaching and learning issues; and (f) methods of outcome assessment. Topics in chapter 3 include the methodology used in this cross-sectional explanatory field study, instrumentation and detailed procedures used for data collection, data recording, and analysis of data, as well as a description of the subjects who participated in the study.

Analysis and presentation of results of the research make up chapter 4. Chapter 5 contains detailed evaluation of the results of the study, conclusions, discussion of results,

a summary of limitations, application to the practice of PT education, and recommendations for future research.

CHAPTER 2: REVIEW OF RELATED LITERATURE

The literature pertinent to this study includes a conceptual framework and design, descriptions of research traditions and philosophies relevant to this project, a review of the GVSU PT curriculum, a historical overview of problem-based learning (PBL) and its anticipated outcomes and benefits (critical thinking and self-directed learning), as well as possible negative aspects of PBL. Literature relating to PBL in medicine, nursing, physical therapy and occupational therapy are thoroughly reviewed. Teaching and learning issues are presented as they relate to student preferences for learning and their growth and development as learners. Finally, tools for assessment of self-directed learning, critical thinking and learner satisfaction/perceptions of learning are explored.

Conceptual Framework

Adult Learning Theory

Contemporary educators credit Knowles (1980, 1984) with describing adult learning theory. He coined the term *andragogy*, which was subsequently described as the art and science of helping adults learn (Knowles, 1984). Knowles proposed a set of four assumptions about adult learners that were contrasted to pedagogy, the art and science of teaching children (Knowles, 1980). Knowles's premises can be summarized in the following concepts: (a) the self-directedness of the learner, (b) the value of experience to the learner, (c) learning readiness as a "need to know" phenomenon, and (d) that adults prefer task or context orientation in learning. Later, Knowles added a fifth premise: Adults are not primarily motivated to learn by external pressures but rather by internal personal drives (Knowles, 1984). Each of these five premises contrasts strongly with the strategies, motivation, and learning contexts of children.

Adult learning theory as a theoretical basis for this study provides additional insight into the development of the GVSU mixed-design PT curriculum. Although the GVSU curriculum in PT has been previously described as influenced by constructive-developmental theory, the curriculum is equally impacted by adult learning theory. An ample number of applications of the premises of adult learning theory are evident in the curricular organization and expectations. The curricular framework provides for progressive use of experience by offering clinical placements placed within didactic coursework. The building or spiraling nature of the curriculum creates a prerequisite need to know for early basic clinical and foundational science content that supports development of skills that occurs later in the curriculum. Laboratory and hands-on skill training provide the adult learner with task-oriented learning that is situated and embedded in the context of didactic courses being taught concurrently. Students are expected to learn not only as a cohort but often in group and individual situations with much emphasis on self-direction. Self-directed learning stressed in group and individual contexts is consistent with the premise of the importance of internal motivation in adult learning.

Adult learning theory influences selection of instructional methods within the GVSU PT curriculum. Instructors who teach in the mixed-design curriculum at GVSU use a wide variety of methods for instruction. Certainly, traditional lecture and demonstration methods are used, especially early in the curriculum, as would be typical in undergraduate education. However, various instructors use a wide variety of other instructional methods within the context of the mixed-design curriculum. Methods such as PBL, case-based learning, seminar, and directed discussion are believed to assist

physical therapists' development of desired skills, such as critical thinking (CT) and self-directed learning (SDL). Each of these methods attempts to engage students in active learning rather than passive reception of information and also pushes the learner to be more self-directed in her/his approach to learning. Therefore, a gradual transition from highly directed, teacher-oriented instruction to more self-directed, active, learner-directed methods is observed throughout the mixed-design curriculum. The question remains as to when, and with what content, this transition between methods is most appropriate and whether methods such as PBL actually develop characteristics of SDL and CT.

Constructivism

Constructivist learning theory is the theoretical context for this project.

Constructivist theory posits ideas about the processes of acquiring knowledge, the nature of knowledge, and the role of the learner during learning. In contrast to traditional behavioral learning theory, which focuses heavily on objective-driven content and structured delivery, constructivism reflects a newer trend that focuses more centrally on the learner and the process of learning, with content delivery (methods) taking a secondary role (Richey, 1996). Constructivist theorists suggest that learning and understanding are functions of individual interpretation (Jonassen, 1991; Lebow, 1993; Fosnot, 1996, 2005) and that each learner's representations of knowledge are constantly open to change. Learning is a dynamic, experiential process during which meaning is constructed (Fosnot, 1996, 2005; Baxter Magolda, 1999).

Constructivism is a psychologically based theory with influences from cognitive sciences, biology, and evolution (Fosnot, 2005). Constructive-developmental pedagogy is based in the theories of John Dewey (1916) and Jean Piaget (Piaget, 1970, 1977). Both

theorists viewed education (learning) as the reorganization, reconstruction, or remaking of experience. Constructivists believe that learning is developmental and involves adaptation, reorganization, dynamic evolution, and transformation (Jonassen, 1991; Lebow, 1993; Baxter Magolda 1999; Fosnot, 2005). Baxter Magolda (1999) described constructive-developmental pedagogy as the process by which an individual discovers what knowing is and how a learner comes to know. Each learner, individually and socially, constructs an internal representation of knowledge and meaning as he or she learns. Constructing meaning is learning; learning is a dynamic process during which meaning is developed on the basis of experience. According to Fosnot (1996), constructive-developmental pedagogy is based on viewing learning as

A self-regulating process of struggling with the conflict between existing personal models of the world and discrepant new insights. Constructing new representations and models of reality as a human-making venture with culturally developed tools and symbols, and further negotiating such meaning through cooperative social activity, discourse and debate. (p. ix)

In short, learning is the process by which knowledge is *constructed* by an individual learner, based upon social interactions, guidance, and instruction within a community (Richey, 1996; Fosnot, 1996, 2005).

Although constructivism should not be considered a theory of teaching (Fosnot, 2005), it provides an important theoretical basis for alternate approaches to curriculum development and instruction. Constructivist theory directs curricular decisions about structure, design, and methodology. Using constructivist principles in curricular design and the processes of instruction means that conditions are provided that invoke

disequilibrium, error, and reflective abstraction. These conditions fuel learning and vital interactive dialogue in a community of teachers and learners that can inspire further thinking and shared expertise. Some education reformers suggest that constructive-developmental pedagogy is essential for the multilayered approach that prepares students to be self-directed, lifelong learners who can keep pace with the evolution of knowledge (Fosnot 1996; Baxter Magolda, 1999, 2001). Development of unique internal models and constructed meaning aids students in becoming self-directed, critical problem solvers in a dynamic healthcare environment rather than relying on memorized facts or concepts that may become irrelevant or obsolete.

Subject-based, instructor-centered methods commonly employed in classrooms of higher education have been shown to have limitations in producing the varied outcomes necessary for allied health professions students (Tavakol & Reicherter, 2003). These outcomes are both quantitative and measurable (study skills, application of knowledge, and skills tests) and qualitative (satisfaction, stress, and comfort). Basing a curriculum on constructive-developmental pedagogy requires that faculty's perspectives on teaching, learning, learners, and the role of faculty (Baxter Magolda, 2001) transform into more progressive perspectives of shared student-faculty learning and less direction by faculty. Instead of faculty's "viewing learning as a linear process, it is understood to be complex and fundamentally non-linear in nature" (Fosnot, 2005, p. 11).

In constructivist theory, learning proceeds toward development of models or schemas that can be generalized rather than toward memorization of facts or specific concepts. This paradigm shift requires faculty buy-in and training to facilitate movement from more traditional methods, such as lecture, to less traditional methods (Creedy &

Hand, 1994; Mifflin, Campbell, & Price, 1999; Baker, 2000). Likewise, faculty should reach consensus about when to initiate certain types of instructional methods in order to present a common, cohesive front in a curriculum.

Not all theorists support the tenets of constructive-developmental pedagogy with equal vigor. Merrill (1992) argued against sole use of constructive-developmental principles because learners do respond to, and learn from, mental models of others. Although students may develop individual internal mental models in most instructional situations, there is a requisite base of core knowledge that may influence individual interpretations and opinions of knowledge (Merrill, 1992). Many PT curricula in the United States remain heavily influenced by behaviorism. Behaviorism in education is characterized by the use of defined behavioral objectives for structuring courses and competency-based testing for evaluating learning.

Constructive-developmental pedagogy has been fundamental in the development of PBL methodology. The relationship between PBL and constructivism is discussed further in a subsequent section on PBL.

Research Traditions and Philosophies

Two distinct types of research, each with distinct theoretical underpinnings and traditions, exist: Qualitative research methods and quantitative research methods. The present research was designed to be a cross-sectional, explanatory field study (Johnson, 2001) during which the researcher used quantitative and qualitative research methods. This study, therefore, represents a mixed-method paradigm (Johnson & Onwuegbuzie, 2004) that uses a blended quantitative and qualitative approach to explore research questions. Each research tradition will be discussed separately and related to the

appropriate theoretical framework and philosophy. The methods used for this study are described in detail in chapter 3.

Quantitative Research Tradition

Quantitative, or hypothesis-driven, research is often associated with the behaviorist and positivist research traditions. Positivism is built on concepts of realism and philosophies dating to Descartes and Galileo (Angen, 2000). The emphasis in positivistic, quantitative research is on predicting and explaining phenomena in a structured, impartial, objective manner. A person with a positivist tradition views the world as a world of objects and data apart from the human observer. The observer is thought to be an impartial, objective gatherer of information. With statistical tests, the quantitative data are analyzed to determine whether significant differences exist between data sets.

An influx of postpositivist traditions in social science research is evident in both healthcare and education literature. Thus, employing a solely quantitative approach may lead to incomplete data and difficulty in explaining the phenomenon encountered.

Qualitative Research Tradition

In addition to the quantitative methods described above, the researcher used qualitative investigation techniques. Qualitative methodology postulates that phenomena can be explained by careful observation of events in order to search for meaning. The interpretive tradition of qualitative research is rooted in the study of people in situations where elucidation of meaning, description of the implementation of treatment interventions, or causal explanations is sought (Shadish, Cook, & Campbell, 2002). Typically, the product of qualitative research is not a formula, the acceptance or rejection

of a hypothesis, or firm predictive knowledge. Rather, the result is an attempt to provide an explanation of actions and phenomena. For clinicians, researchers, and educators within the field of PT, practical understanding consists of interpretation of actions and situations that involve human dynamics, communication, and experiences (Malterud, 2001).

Interpretivist tradition encompasses research methods, not only for collection and interpretation of data, but also for a philosophical approach that relates to the nature of knowing and role of the researcher. The interpretivist approach enhances understanding of clients, students and community and also makes explicit the reflections of the researcher. In interpretive theory, the researcher is not separate from the subject(s) of inquiry or research but, rather, is close to and has interactions with the subjects. Reality is constructed through the meanings that are extracted from within the social world (Angen, 2000); understanding cannot be separated from context. According to Brantlinger, Jimenez, Klinger, Pugach, and Richardson (2005), “Qualitative research is not done for purposes of generalization but rather to produce evidence based on the exploration of specific contexts and particular individuals” (p. 203). A study of students using a purely rationalistic or positivistic approach would limit the amount of understanding and meaning that could be gleaned. The perceptions of students in the context of a curricular design can be better understood when interpretivist theory is applied in qualitative methodology, along with quantitative methods and theory.

Physical Therapy Education

Physical Therapy education is a prescribed process by which faculty in educational institutions teach, develop, and transform individuals into professionals

capable of practicing as Physical Therapists (PTs). Physical therapist education programs function within the structure of the educational institutions and under the accreditation standards of the Commission for Accreditation of Physical Therapist Education (CAPTE). Although all PT education programs must adhere to basic requirements in order to be accredited by CAPTE and allow for their graduates to take a national licensure exam, innovation and variation of instruction within professional education programs are respected and encouraged. Various curricular and methodological models exist within the PT education community: a medical approach, a systems-based approach, a developmental approach, and various combinations of these. Each of these models is used in the development of traditional, mixed-design, and fully problem-based learning (PBL) curricula.

Grand Valley State University Physical Therapy Curriculum and Philosophy

The stated vision of the GVSU PT program faculty is “To be a model of excellence in physical therapy education” (*Grand Valley State University Physical Therapy Program Handbook*, 2003, p. 2). The mission of GVSU PT is to provide students the quality of education necessary to attain entry-level competencies in clinical practice, education, consultation, and research. The faculty promote and enhance the mission by providing experiences that facilitate learning, critical thinking, and a commitment to life-long learning. Williams (2001) stated that “professional education shares the common goal of preparing competent graduates who will successfully make the transition to professional practice” (p. 27). The faculty strives to develop reflective practitioners who are prepared to practice in a direct-access environment and responsibly address societal healthcare needs.

Skills and Attributes of a Physical Therapist

A PT curriculum is a plan for learning designed by the program faculty to achieve explicit goals and objectives for preparation of a physical therapist. Curriculum planners are responsible for organizing and articulating a means by which faculty can present the knowledge, skills, attitudes and values needed to achieve the educational aims. Central aspects of the curriculum are the educational philosophy, the individuals who teach in it and their values, and the knowledge of and beliefs about learning. The GVSU PT program philosophy includes the following key components: (a) professionalism, (b) problem solving, (c) critical thinking, (d) ethical decision making, (e) evidence-based and reflective practice, (f) use of a holistic systems perspective, (g) ability to use interdisciplinary practice, (h) physical therapist as an educator and life-long learner, (i) physical therapist as consumer and producer of research, and (j) physical therapist as an effective communicator, consultant, and collaborator (*GVSU Physical Therapy Handbook*, 2003).

Mixed Curricular Design

Many schools where faculty provide instruction for health professionals use curricula that combine traditional methods and other less traditional methods such as PBL. Tavakol & Reicherter (2003) and other proponents of combined methods describe this mixed curricular design as a proficient approach to medical and allied health education. They describe the transitional model as comprising subject-based courses early in the curriculum, followed by courses with more clinically based scenarios and problems presented in varied formats. This approach has also been described as a hybrid

design (Saarinen-Rahiika and Binkley, 1998), or mixed-design curriculum, as it is called at GVSU.

The mixed curricular design of the GVSU PT program comprises a variety of teaching methodologies based on individual course content and instructor philosophy yet emphasizes critical thinking and self-directed, life-long learning throughout. “It is more effective to design curriculum so that there is some way for learners of every learning style to engage with the topic so that every type of learner has an initial way to connect with the material, and then begin to stretch his or her own learning capability in other learning modes” (Delahoussaye, 2002, p. 31). Courses placed early in the curriculum are more content driven and tend to use more lecture-based classroom instruction and structured laboratory time. As students mature, adapt, and progress through the curriculum, more case-based and problem-based instruction are included. Such methods enhance and facilitate independent thinking, the critical thinking process, and the self-directed approach to learning. These methodologies align well with the curricular philosophy and theoretical basis (adult learning and constructive-developmental pedagogy) upon which the curriculum is built. The GVSU PT curriculum is dynamic and includes ongoing review and development to incorporate current physical therapy practice and educational theory, as well as changes in healthcare delivery. It is important to study the GVSU mixed-design curriculum to examine its effectiveness and determine its effects upon students.

Historical Overview of Problem-Based Learning (PBL)

Problem-based learning has become a pedagogical topic of interest in medical and allied health education. Implementation of student-centered PBL instruction is considered

one of the most important developments in professional education in the past two decades (Maudsley, 1999; Tavakol & Reicherter, 2003). PBL uses problems, carefully structured into patient cases, as the contexts for seeking and organizing knowledge. The fundamental assumption of PBL is that students take the majority of responsibility for their own learning by working in groups, where they formulate hypotheses, search for and present relevant information, and attempt to provide a solution to a problem.

Problem-based learning stands in stark contrast to traditional, teacher-centered methods of teaching and learning. Scholars involved in design, development, and study of instructional methods are questioning the effectiveness of traditional educational practices, especially in the education of healthcare professionals (Bruhn, 1992; Creedy & Hand, 1994; Heliker, 1994; Dolmans & Schmidt, 1995; Royeen, 1995; Antepohl & Herzig, 1999; Baker, 2000; McGinty, 2000; Jefferson, 2001; Tavakol & Reicherter, 2003). Proponents of various nontraditional methodologies argue that traditional instruction, guided by predefined objectives, tends to be highly prescribed and functions primarily for transmission of facts rather than for facilitation of the process of learning (Richey, 1996). PBL is purported to facilitate deep rather than surface, or factual, learning. Kember and Murphy (1990) reported that surface learning is less likely to be transferred by the learner into new situations than is learning of greater depth. Depth of learning is vitally important to health professions education because new situations constantly arise that cannot be approached effectively with factual knowledge alone. Rather, assessing new situations often involves the use of deep learning, such as critical analysis, reflection, and decision-making skills. Students must be prepared with

transferable types of learning that can expand and deepen as their experience base and skills develop.

Several principles from cognitive science are fundamental to PBL: (a) Active learning enhances retention of knowledge, (b) prior knowledge helps with subsequent management of new information, (c) elaboration of knowledge facilitated by small-group work and discussion enhances subsequent retrieval, (d) contextual learning promotes retention, and (e) repeated problem solving improves the scientific reasoning process (Jefferson, 2001; Papa & Harasym, 1999; Norman & Schmidt, 1992). These methods of PBL promote the outcomes educators hope to achieve. Therefore, if the proposed benefits of PBL, such as enhanced problem solving, improved CT, improved SDL, critical reflection abilities, and life-long learning, occur, they do so because of the factors stated above.

Historical Development of Problem-Based Learning

The historical development of PBL and its relationship to desired PT outcomes is fundamental to this project. The literature establishes a basis for studying PBL in the context of the outcomes of self-directed learning (SDL) and critical thinking (CT). Since its inception in the 1950s, PBL has been arguably “the most important innovation since educational institutions became responsible for professional education” (Maudsley, 1999, p. 178). The PBL approach grew from the premise that physicians needed to learn not only the technical side of medicine, but also the human side. Although McMaster and Case Western Reserve Universities were the first to adopt PBL as an instructional approach for instruction of medical students in the 1960s, Harvard Medical School adopted a PBL program in the 1980s (Tavakol & Reicherter, 2003). Also during the

1980s, the practices of PT and occupational therapy (OT) grew from being technical and skill based to being highly conceptual, requiring greater skills in decision making and problem solving. Educators of PTs and OTs were challenged to adapt educational programs to meet the needs of professionals who were expected to use clinical reasoning skills and utilize findings from a growing body of research evidence in their practice. In 1990, McMaster University pioneered PBL curricula for both PT and OT programs. As higher education instructors attempt to prepare learners for life-long learning, critical thinking, and alternative views of knowledge, PBL has emerged as an important instructional methodology and curriculum organizational framework. Many more programs now use some form of PBL to educate professionals in the discipline of PT (Tavakol & Reicherter, 2003). GVSU is one that uses a mixed-design curriculum in which PBL as an instructional method is introduced in single courses during the second semester.

Several approaches to the use of PBL have been described in the literature, including (a) completely integrated PBL curricula; (b) transitional or *hybrid* curricula that utilize traditional teaching approaches early in the curriculum and gradually shift to small-group and student-centered learning methods, including PBL; and (c) single courses taught using PBL methodology (Saarinen-Rahika & Binkley, 1998). The GVSU PT mixed-design curriculum is most like the transitional, or hybrid, curricula.

Because many PBL issues and descriptors are closely interrelated and often poorly defined, care must be used in reading, examining, and interpreting the available literature related to PBL. It is important to determine whether PBL is the instructional method for a single course or a unit within a course or is the organizing curricular

construct. PBL courses and modules are used to present all curricular content in a fully integrated PBL curriculum, to the conscious exclusion of other methods of instruction. It is important not to compare outcomes of a mixed-design curriculum with outcomes of a fully integrated PBL curriculum, as their structures, goals, and methods are different.

Application and interpretation of the PBL literature is often confounded by the confusion in the terminology surrounding PBL. Many methods are described as PBL, including case-based learning, discussion, and inquiry-based learning (Maudsley, 1999; Magnussen et al., 2000). However, true PBL-oriented methodology differs remarkably from these methods in implementation, role of the instructor/tutor, and structure of the classroom interactions. The following review of related literature uses consistent and clear terminology to avoid confusion. Henceforth, the descriptor PBL will be used to denote a type of instruction used to deliver content, a PBL-structured curriculum will be described as PBL-C, and the hybrid, or mixed-design, curriculum will be called a mixed-design curriculum.

PBL Research in Health Professions Education

Problem-based learning for healthcare professionals utilizes clinical scenarios as contexts for learning. Saarinen-Rahiika and Binkley (1998) stated that “[t]he goals of healthcare scenarios are to provide a context for learning, to activate prior knowledge, to motivate students, and to stimulate discussion” (p. 195). “Knowledge arises from working on a problem rather than, as with problem solving, being a requisite for working on a problem” (Ross, 1991, p. 36).

Problem-based learning is a method used for instruction in many disciplines, including medicine, nursing, occupational therapy, accounting, and engineering.

Research on PBL in PT is scant. Most of the original research on PBL as an instructional method and curriculum framework has been conducted in medical schools (Patel et al., 1991). The next section summarizes research from predominantly medical literature, with some contribution from nursing and allied health literature.

Derechchin and Contant (1999) investigated the learning behaviors of medical students, using the Cognitive Behavior Survey, a self-report instrument. Four hundred eighty medical students in three successive classes were asked to rate their ability to acquire and conceptualize medical knowledge. The 1995 class had 150 students enrolled in the traditional curriculum, the 1996 class had 165 students enrolled in the traditional curriculum, and the 1997 class had 165 students enrolled in a mixed-design curriculum. Mean Medical College Admission (MCAT) test scores and GPA scores were obtained as cross references. There was little difference in the mean GPA (3.7), and the MCAT scores were similar (10.7 on a scale of 15) for all classes, with the 1997 class having slightly higher mean scores. All classes reported the importance of self-directed learning formats. An interesting finding was that the 1997 (mixed curricular design) class indicated a desire for more traditional lecture than did the other classes. The 1997 class also rated SDL significantly lower than did the other two classes. There were no significant differences between the classes regarding resources for knowledge. All students reported that textbooks, syllabi, course outlines, and lectures were their primary resources, and no significant differences were noted in the variety of resource used in the classes. The results of this study are difficult to interpret. The students in the mixed-design curriculum rated concepts within SDL higher, yet their rating for active forms of learning were lower than the ratings of traditional participants. The authors noted that the

extensive changes and growth required of those enrolled in the mixed-design curriculum may have influenced the results but concluded that there was a positive trend toward students' embracing PBL as a method for life-long learning.

Warburton and Whitehouse (1998) studied 118 medical students' perceptions of how well a PBL approach improved their integration of knowledge, using a structured questionnaire given at the half-way point of a year's PBL curriculum. The descriptive results indicated that 45% of the students described satisfactory understanding of the course objectives, and 65% indicated that they enjoyed the course. Thirty-nine percent of the students indicated the same amount of understanding as in a traditional course, and 27% reported the same level of enjoyment. Forty-eight percent reported experiencing the same amount of work, and 30% reported a greater amount of work in PBL course. The authors concluded that while PBL groups were enjoyed and course objectives were being met, the PBL process was not meeting students' personal goals. The authors recommended further research to consider differences in the learning wants and needs of students.

Antepohl and Herzig (1999) conducted a randomized, controlled experiment of 123 medical students in their fifth year who were enrolled in a basic pharmacology course. The students were enrolled in two sections of the course, each involving different teaching methods. They enrolled randomly, due to blinding of the registration staff to the teaching method to be used in sections. Sixty-three students were assigned to the PBL group and were further divided into eight PBL groups. Sixty students were assigned to the control (traditional lecture method, or TLM) group. Student evaluations included a written final examination, a questionnaire regarding preference of teaching methodology,

and a second questionnaire addressing satisfaction with the PBL course alone. The results of the study indicated no significant differences between the PBL group scores and the TLM group scores across comparable parameters. The PBL group had higher scores only on the short-answer component of the final exam. Comparison of examination scores of the eight PBL groups showed similar scores for the short answer and multiple choice questions. The PBL students indicated an overall level of satisfaction with the PBL course and considered it to be an effective learning method. The authors concluded that PBL was an equally, if not more, effective method of learning as the traditional lecture format. The study also supported high levels of satisfaction with learning after a PBL experience.

Miflin, et al. (1999) studied 234 medical students in a PBL curriculum and focused on the impact of an orientation process for both faculty and students. Four essential items that positively influenced the PBL process were identified: (a) An orientation that provided clear instructions and introduction to the PBL process and SDL principles, (b) a need for focused briefings regarding resources, (c) a weekly lecture to review basic principles, and (d) regular formative evaluations for both faculty and students. The authors noted that students were dependent in the beginning and needed direction to accommodate the demands of PBL and SDL. It was also important for faculty to shift from the role of expert to one of facilitator and guide. This issue of faculty's transformation of instructional style will be discussed further in a later section.

Albanese and Mitchell (1993) conducted a meta-analysis to address PBL and learning outcomes in 17 medical schools in the United States and internationally by comparing results from 17 published studies. The authors noted the difficulty in

establishing consistent outcome measures. Scores on standardized achievement tests known as the National Board of Medical Examiners (NBME) tests, as well as scores on basic science tests, were used as outcomes measures. Many flaws in the experimental designs of previous research limited comparison between studies. Results described by Albanese and Mitchell indicated that PBL students showed consistently lower basic science scores but statistically better ($p < .10$) recall and clinical reasoning abilities than did the control groups. The meta-analysis also indicated that the PBL students studied differently than their traditional-curriculum counterparts and that SDL tendencies evolved as a result of PBL.

The literature regarding PBL in medical education is somewhat controversial. Much research has been performed on medical students, and the findings offer little clarity on the outcomes related to PBL, including CT and SDL.

Proposed Benefits of PBL

Four closely related variables are proposed as benefits or outcomes of PBL: Problem solving, critical thinking, self-directed learning, and critical reflection. These outcomes often overlap, not only in their descriptions, but also in their eventual utilization by health professionals. PBL is connected in the literature to each of these proposed outcomes, although the evidence varies regarding the support for the ability of PBL or PBL-C to develop any of these characteristics in students enrolled in PT or other health professions courses. Each of these variables will be discussed separately because of their relationship to the current project, either as an outcome measure or because of exclusion as a facet of the study.

Problem Solving

The following section contains a discussion of the construct of problem solving, the contexts in which it is thought to occur, and the literature relating the development of problem solving to PBL. Problem-solving abilities and strategies vary among individuals. Disagreement exists about whether such skills can be taught, promoted, or developed by instructional methods.

Problem solving is a crucial skill for PTs in daily practice. In addition to the multitude of factual items and skills to be learned in a PT program, students must also learn how to solve problems. Therefore, a goal of many faculty in PT programs and curricula is to promote higher level cognitive skills, such as problem solving. The PBL approach to teaching is believed to encourage the development of problem solving. Proponents of PBL believe that it helps students become good problem solvers and helps them to learn clinical reasoning skills (Coles, 1990; Dolmans & Schmidt, 1995; Saarinen-Rahiika & Binkley, 1998; Jefferson, 2001).

Since the 1980s, PT curricula have placed emphasis on problem solving and evidence-based inquiry as important skills for a physical therapist, in contrast to earlier PT curricula that focused more on total mastery of content-specific information and technical performance of tasks (Graham, 1996). Educators have long debated the dichotomy between the roles of general knowledge and specific-domain knowledge as predictors of effective problem solving (Perkins & Solomon, 1989). General knowledge and skills are used for general behaviors such as critical thought and reflection. Specific-domain knowledge relates to content and factual information critical for the practice of PT in areas such as physiology, anatomy, use of examination tools, and prescription of

exercise. Therefore, instructors who use the mixed-design curriculum seek to balance and vary content to deliver both general process skills, such as CT and SDL, and specific-domain knowledge and skills relevant to the practice of PT. This balance should enable students to become skilled problem solvers and clinical decision makers as they use domain-specific facts and skills. However, there is no research to support the previous claim. Kaufmann, Portney, and Jette (1997) showed no difference in clinical education scores for traditional versus PBL-trained physical therapists, and other studies have suggested that there is no significant difference in basic science knowledge or examination performance between students instructed via traditional methods and those instructed with nontraditional methods (Dolmans & Schmidt, 1996; Solomon et al., 1996).

The challenge to PT students today is to become active, critical thinkers and dynamic problem solvers (McGinty, 2000). Unfortunately, problem solving is a complex, multifaceted, poorly understood construct or skill (Jonassen & Hernandez-Serrano, 2002). In fact, according to Norman and Schmidt (1992), “The issue of the effect of curriculum on ‘problem solving skills’ may well be viewed as a moot point, since the very existence of problem solving skills can be challenged” (p. 564).

Proponents of PBL suggest that their students develop enhanced problem solving skills (Burnett & Pierson, 1988; Solomon, Binkley, and Stratford, 1996; Jonassen & Hernandez-Serrano, 2002). As an instructional strategy, PBL places students in problem-solving situations (Bruhn, 1992; Albanese & Mitchell, 1993) and assists students in adding new information to existing information (Albanese & Mitchell, 1993) by asking them to solve the problems presented. Problem solving encountered in professional

education requires more advanced patterns of thought than most students have used in their previous education (Burnett & Pierson, 1988). Learning experiences or instructional methods designed to enhance a student's problem-solving abilities will provide students structured ways to practice such skills. Therefore, the goal of the use of PBL methods within a professional curriculum is to develop advanced thought patterns. PBL is purported to assist students in learning at higher taxonomic levels, such as integration, analysis, and synthesis, rather than at lower taxonomic levels such as simple knowledge and memorization. The outcomes of integration, analysis, and synthesis of content each support cognitive abilities believed essential to problem solving (Vroman & MacRae, 1999). However, some studies of medical students have shown no differences in problem solving processes or ability in students of PBL and traditional curricula (Berkson, 1993; Norman & Schmidt, 1992; Neufeld, Norman, Barrows, & Feightner, 1981). Several authors have suggested that PBL uses a form of reasoning called backward reasoning, or hypothetico-deductive reasoning, which moves from a hypothetical solution to explain observable details. This type of reasoning is typically used by novices or those with insufficient knowledge (Patel, et al., 1991; Albanese & Mitchell, 1993). Backward reasoning has been contrasted in the literature with its counterpart, forward reasoning, the method of reasoning and analysis used by experts. Patel et al. (1991) noted that training in backward reasoning might inhibit development of forward, or sophisticated, expert reasoning strategies. Currently, there is no evidence to support the claim that students of PBL are more effective problem solvers than traditionally educated students (Saarinen-Rahiika & Binkley, 1998). This study does not seek to measure outcomes of courses that might provide the construct for the development of problem solving.

The task of promoting higher level cognitive skills, such as problem solving, is difficult (Jefferson, 2001). Likewise, it is very difficult to measure problem-solving competencies because many individual factors exert influence on the process. Burnett and Pierson (1988) described the relationship between cognitive development, personality, and problem solving. They stated that both the developmental level and personality of the learner strongly affected his/her relative comfort or discomfort with gray areas and unproven answers in the process of problem solving. Thus, developmental level and personality may affect a learner's comfort with the PBL process.

Norman and Schmidt (1992) asserted that although PBL students may be able to transfer concepts to new problems, there is no evidence indicating that any type of curriculum or method is able to enhance students' problem-solving skills apart from their acquisition of knowledge or content. Varied developmental level, personality type, and learning style may affect an individual's ability to be proficient at problem solving, apart from practice or instructional method.

Perkins and Solomon (1989) concluded that both general and specific contexts must be included in educational instruction to maximize the transfer and long-term retention of knowledge. PBL uses general problem-solving contexts to teach both problem-solving skills and content with the assumption that specific content or facts will be gleaned. An interesting finding was that repeated exposure to PBL sessions does not appear to increase students' problem-solving skills and may deter problem solving because of insufficient development of base knowledge (Jefferson, 2001). In five separate examinations of the literature, no evidence was found that indicates that PBL teaches problem solving better than does traditional curricula (Patel, et al., 1991; Norman

& Schmidt, 1992; Albanese & Mitchell, 1993; Vernon & Blake, 1993; Saarinen-Rahiika & Binkley, 1998). Because problem solving is an abstract, difficult concept to define and measure, it has been eliminated as an outcome variable in the context of this research.

Critical Thinking

Critical thinking (CT), like problem solving, is of crucial importance to the health professional. The following section contains the definition of critical thinking (CT), its relationship to clinical practice, the role of PBL in the development of CT, and existing research about development of CT in PT students. The term *critical thinking* describes the inductive and deductive reasoning skills foundational to decision making (Vendrely, 2005). In health professions education, CT is important for clinical judgment, decision making, and clinical reasoning (Higgs & Jones, 2003).

There are many definitions and understandings of the term critical thinking. The American Psychological Association published the following definition of CT from a consensus report based on the views of 46 published CT theorists from numerous disciplines: “Critical thinking is the process of purposeful, self-regulatory judgment. This process gives reasoned consideration to evidence, contexts, conceptualizations, methods and criteria” (American Psychological Association, 1990, p. 2). Earlier, Ennis (1962) presented a broad definition of CT and stated that “in all cases requiring judgments about the world of things, men, and events, these criteria must be applied with discretion; they are not applied mechanically” (p. 170).

Watson and Glaser (1980, 1994) defined CT as a combination of attitudes, knowledge, and skills.

This composite includes (a) Attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true; (b) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined; and (c) skills in employing and applying the above attitudes and knowledge. (1994, p. 9)

CT in the health professions is about making good clinical judgments (Rubinfeld & Scheffer, 1999). CT abilities may be inherent to the individual and related to individual factors, and the general skills may be acquired in the context of professional education, but controversy exists as to whether CT can be taught. Many instructors in health professions education believe that CT may be difficult to teach but suggest that strategies for clinical decision making or clinical reasoning *can* be taught. (Edwards, Jones, Carr, Braunack-Mayer, & Jensen, 2004).

Clinical decision making has been described as the application of CT in a practice setting (American Psychological Association, 1990). Such CT should be included as a part of professional education in health disciplines. In fact, the emergent healthcare environment affecting all healthcare professionals demands that they have the ability to practice in a data-driven, evidence-based mode (Baker, 2000). According to Bruhn (1992), “the allied health professional who remains competent despite change will be a self-directed learner and critical thinker” (p. 170). Clearly, CT is a vital skill for those who seek to practice in current and future healthcare arenas. The development of critical thinking and critical judgment are first-priority outcome goals in the latest position statement on nursing education by the American Association of Colleges of Nursing

(American Association of Colleges of Nursing, 1999). However, in an exhaustive review of 20 studies that measured CT among nursing students, Adams (1999) concluded that there was no strong evidence to support the belief that participation in a nursing curriculum produced improvement in CT skills. Similarly, professional educators of PTs also stress the development of clinical reasoning and clinical decision-making skills (Vendrely, 2005).

Problem-based learning is one possible way to teach CT. In PBL as an instructional method, faculty use cognitive processes that support clinical reasoning and associated CT skills (Magnussen, et al., 2000). Clinical reasoning (as a form of CT) and critical reflection may be touted as the greatest assets of PBL, but the development of these characteristics, as a result of problem-based instruction, remains suppositional (Royeen, 1995). Research on PBL as a promoter or developer of CT is difficult because a reliable, valid, utilitarian instrument for measuring CT and reasoning does not exist (Vroman & MacRae, 1999). Wilson (2000) suggested that PT educators develop a framework for understanding the clinical decision-making process used in physical therapy and its link to CT.

Research on the development of CT among PT students has had mixed results (Vendrely, 2005). Studies using standard psychometric measures of CT, such as the Watson Glaser Critical Thinking Appraisal (WGCTA), have shown nonsignificant results in the development of CT and problem solving in Nursing, OT, and PT students when such measures were used in various research designs (Slaughter, et al., 1989; Vroman & MacRae, 1999; Daley, Shaw, & Balistreri, 1999; Wilson, 2000). These varied research outcomes may result because the WGCTA is based upon the assessment of CT in daily

living situations rather than competence in reasoning or judgment in clinical practice situations (May, Edell, Butell, Doughty, & Langford, 1999; Wilson, 2000). It is important to continue to study CT in PT students, qualitatively and quantitatively, in order to determine the development of this construct.

Other studies of the development of CT in PT students have used quantitative tests other than the WGCTA. One longitudinal study that used both the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI) found significant improvement in CT during the middle year of an undergraduate PT curriculum (Bartlett & Cox, 2002). However, in contrast, PT students studied by Wilson (2000) did not demonstrate improvement in CT as measured by the CCTST and CCTCI over two semesters in a graduate PT program. The current research did not use either the CCTST or the CCTCI as measurement tools but may offer some insight into development of CT using the WGCTA as an assessment tool for CT during the first three semesters of a mixed-design PT curriculum.

Norman and Boonyawiroj (1997) used the Test of Logical Thinking (TOLT) with 80 first-year students enrolled in a Master's degree PT education program. Significant differences ($P < .001$) were found between TOLT preentry scores and TOLT scores at the end of the first year. The researchers concluded that instruction during the first year of the PT educational program produced cognitive change in students (Norman & Boonyawiroj, 1997) but did not equate logical thinking with CT. Whether the TOLT validly measures CT has not been established.

Very few other studies of PT students using the WGCTA exist. Because CT may relate to individual qualities such as academic achievement, Gross (1989) performed a

study of the relationships between WGCTA scores, grade point averages (GPA) in the PT program, and performance on the National Physical Therapy Examination licensure exam. Gross found statistically significant correlations between the WGCTA and GPAs ($n = 53$; $r = 0.29$; $P = .037$) as well as between the WGCTA scores and licensure examination scores ($n = 41$; $r = .47$; $P = .002$). It must be noted that this research studied three undergraduate PT educational programs, of which only one used the WGCTA as an admission criterion. No further administration of the WGCTA was performed during or at the conclusion of the curriculum. Inferences about development of CT cannot be made on the basis of the research of Gross (1989).

Vendrely (2005) used the CCTST for assessment of 66 physical therapy students admitted to a Master's Degree program. The students' average age was 26.52 years old. Using a pretest, posttest design, students were given the pretest CCTST during orientation, prior to beginning coursework. The posttest was administered during the last week in the program, which consisted of 7 semesters of didactic and clinical instruction over 27 months. Students' mean scores on the composite CCTST were 19.31 for the pretest and 20.60 for the posttest, indicating no significant change in CT skills as a result of the PT educational process. Vendrely (2005) suggested several reasons for the lack of significant results: A possible ceiling effect, altered conditions between pre- and posttest administration, and the small sample. She also speculated that the CCTST may not be a meaningful measure of CT skills of PT students, which is the same concern described for the WGCTA. Vendrely (2005) recommended working toward a theory of CT for PT students to assist in developing a meaningful measurement tool for CT in PTs.

Several gaps remain in the current physical therapy literature related to CT. Many studies use primarily undergraduate students (Slaughter et al., 1989; Gross, 1989), and most PT education programs are now at the postbaccalaureate level. Students enrolled in graduate studies may be older and more experienced and have different nonlinear ways of learning things such as CT (Vendrely, 2005). Therefore, continued study of the cognitive construct known as CT in graduate-level PT students is warranted.

Self-Directed Learning

Self-directed learning (SDL), like problem solving and CT, is essential to the successful health professional. The following topics are discussed in this section: A definition of SDL, contexts in which SDL occurs for adult learners, SDL as a proposed outcome of PBL, the role of PBL in the development of SDL, existing research about development of CT in medical and PT students, and the linkage of SDL to the construct of life-long learning.

Self-directed learning is a method of education rooted in the work of Houle (1961), Tough (1971, 1979), and Knowles (1975). SDL has been described as “intentional learning where the individual’s major goal is to gain and retain a clearly defined knowledge or skill or to produce a lasting change in behavior, attitudes, or knowledge in the self” (Linares, 1999, p. 408). By the SDL method, the individual determines the details of content to be learned and the approach to use in the learning process. Although outcomes and objectives for learning are teacher driven, the learner takes primary responsibility for the process of learning. Adult learners are often described as being self-directed in their learning processes (Knowles, 1975; Knowles, 1980; Linares, 1999), as well as being comfortable with self-direction.

However, self-direction may be contextual. Most adults are highly self-directed in the events of their personal lives but may be less so within the educational environment (Linares, 1999). Many adult students reported that previous educational experiences existed in rigid, highly structured teaching and learning environments (Linares, 1999). Therefore, these students may not be comfortable with self-direction in the context of their education. Experience affects individuals' perceptions of learning.

Age also appears to affect self-directed learning readiness. Linares's (1999) study of allied health students demonstrated that students who had highest scores on the SDLRS, and therefore classified as "highly self-directed" (p. 6) were older than those with average or low scores on the SDLRS. Therefore, students in a graduate program, depending on their ages, may be more or less ready for self-directed learning endeavors. Self-directedness may also be related to an individual's learning style, which may influence how each person learns and how readily he or she adapts to self-directed learning environments. Learning styles will be discussed in detail in a subsequent section.

Several authors have asserted that PBL methods challenge learners to seek knowledge for themselves rather than expect the teacher to bring knowledge to them (Barrows, 1985; Vernon & Blake, 1993; Saarinen-Rahiika & Binkley, 1998). The aforementioned belief is consistent with the vision of a self-directed learner. Proponents of PBL believe that students learn for the sake of learning rather than memorize factual knowledge in order to pass tests (Jefferson, 2001), a concept that is related to SDL. SDL is one of the hallmark outcomes proposed as being associated with PBL (Barrows & Tamblyn, 1980) and is a highly desirable characteristic in health professionals. The

ongoing pursuit of knowledge throughout a career is described as life-long learning. Medical students who graduate from PBL programs are more self-directed as well as more engaged life-long learners (Norman & Schmidt, 1992; Vernon & Blake, 1993; Vernon, 1995; Dolmans & Schmidt, 1995). Students in PBL programs develop enhanced skills for building on existing knowledge, as well as enhanced self-directed study skills, both of which are crucial for the life-long learning behaviors expected of professionals (Tavakol & Reicherter, 2003). SDL practices in health professionals might be demonstrated by reading and analyzing new evidence or information, making judgments about the merit of varied information, and merging this with preexisting knowledge. The self-directed health professional is constantly searching, learning, analyzing, and making alterations in his/her practice on the basis of ever-changing trends, evidence, and research (Higgs & Jones, 2003). Ideally, self-directed learning behaviors occur not only during formal education but continue throughout the career of the health professional. Self-directed, life-long learning is a highly desirable trait in health professionals, necessary for ongoing excellence in a technology-based, fast-paced, changing practice environment, no matter the discipline (Tavakol & Reicherter, 2003).

Self-directed and life-long learning practices also match the characteristics of the reflective practitioner as described by Schön (1987), which will be discussed further in the next section. SDL is believed to be an important learning skill used by the reflective clinical practitioner (Lake, 2001). This self-directed, reflective practitioner is consistent with the vision of *The Normative Model of Physical Therapist Professional Education, Version 97* (American Physical Therapy Association, 1997), which states that

autonomous or SDL is a key element of a reflective practitioner. The normative model does not, however, offer any suggestions on developing SDL in PT students.

As PBL becomes more popular in medical and other health professional educational programs, its proponents suggest that the PBL method produces more self-directed learners (Solomon, 1994; Solomon et al., 1996) than do other educational methods. Regarding the perceived benefits of PBL, Dolmans & Schmidt (1995) stated that “students should become architects of their own knowledge and eventually take full responsibility for their own learning” (p. 207). Responsibilities for one’s own ongoing learning is certainly the intent and desired outcome of SDL. However, whether PBL promotes the outcome of SDL remains uncertain.

According to a literature review by Norman and Schmidt (1992), PBL appears to enhance SDL in medical students. Likewise, Vernon and Blake (1993) concluded, on the basis of their meta-analysis, that medical students of PBL programs engage in more individual study than do students of traditional programs. Solomon, et al., (1996) investigated the relationship of PBL to SDL in PT students by examining levels of resource use and time spent studying. They found that PT students reported high levels of study time and felt competent with information-seeking skills. The authors suggested that both of these characteristics of SDL demonstrated the students’ use of prior knowledge to diagnose their own learning needs and search for a variety of resources. No direct comparison of resource use and study time between PBL and traditional PT students exists. An interesting finding was that SDL, as measured by library use, decreased in PT and OT students throughout the course of their curriculum (Williams, Saarinen-Rahiika, & Norman, 1995). Although this phenomenon is not fully understood,

the authors suggest that decreased time spent in self-directed educational activities indicated increased efficiency with learning resources.

Coles (1990) related SDL in PBL to contextual learning theory. In PBL, students engage in self-directed study to discover relevant information within contextual situations (problems). Coles (1990) reported that learning occurs when newly discovered information is related to preexisting knowledge through elaboration and use of critical thinking. Learning occurring in SDL contexts may differ between students of PBL and conventional curricula. Rankin (1992) reported that medical students in PBL courses and curricula used more journals, did more on-line studies, generally used the library more, and felt more competent in information-seeking skills than did students in conventional programs. These self-directed learning behaviors described by Rankin would be equally as important to PT students as to medical students. Although both Blumberg and Michael (1992) and Rankin (1992) reported positive differences in time spent studying, use of the library, and reliance on informational resources, it has not been established that these outcomes actually represent enhanced SDL.

Linares (1999) studied self-directed learning in allied health programs, including nursing, OT, PT, physician assistant studies (PAS), and medical technology (MT), using the SDLRS. According to Guglielmino (1978), SDLRS scores between 235 and 290 indicate high SDL readiness; 216 indicates low SDL readiness. Linares (1999) reported that all health professions students were “highly self-directed” (p. 5) except the PT and OT students. Of the PT students ($n = 31$), 7 (22.6%) scored in the low range, 12 (38.7%) scored in the average range, and 12 (38.6%) were in the high range.

There is an important link between SDL and life-long learning behaviors needed by practitioners to keep up with the ever-changing professional landscape. According to Hay (1995), skill in self-evaluation is requisite for motivation and direction of life-long learning. Self-monitoring, or self-evaluation, is part of the metacognitive process that learners use to drive themselves toward responsibility for learning (Garrison, 1997), a critical developmental step toward life-long learning. Metacognition is defined as thinking about the process of thinking. In PBL, therefore, the emphasis on SDL should encourage reflection upon learning by the student and foster the development of life-long learning strategies critical to successful professional practice. Although they are intertwined, the complex relationship between PBL, SDL, and the development of life-long learning skills remains worthy of ongoing investigation.

Lunyk-Child, Crooks, and Ellis (2001) studied faculty's and students' perceptions of SDL in nursing education. They described a developmental process that occurs during the transition from teacher-centered to student-centered educational methods and asserted that this development needs to be understood, recognized, and nurtured by faculty to assure appropriate transition by students. Because the readiness for SDL is a construct that has been explored (Guglielmino, 1978; Walker, 2001) and may be affected by educational methods such as PBL, the SDLRS was used to investigate SDL as an outcome in this study. Likewise, students' perceptions of SDL as an educational strategy necessary for success in PBL methodology were examined.

Critical Reflection

Reflection, a hallmark of transformative learning, can be traced to John Dewey (1933), who described reflection as “active, persistent and careful consideration of any

belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it tends” (p. 9). Reflection, reflective thought, and critical reflection are organizational constructs of transformative learning theory based on constructivist theory and assumptions (Williams, 2001). Transformative learning theory proposes that people interpret experiences in personal, individual ways. Individuals then interpret and understand the world relative to their perceptions of their experiences (Mezirow, 1990). Much of the current thinking on reflection is based on writings by Mezirow (1990) and Schön (1987). Reflection has also been defined as “a generic term for those intellectual and affective activities in which individuals engage to explore their experiences to lead to new understandings and appreciations” (Boud & Feletti, 1997, p. 3). Schön (1987) suggested that professions need to educate reflective practitioners who can solve common problems in their practice by application of knowledge to those problems.

The skill of reflection is an important outcome of health professional education in many fields, including medicine, dentistry, PT, nursing, occupational therapy (OT), and physicians assistant studies (PAS) (Bruhn, 1992). Reflection is an important professional skill (Schön, 1987; Meizerow, 1990; Bruhn, 1992; Williams, 2001), but strategies for its development are uncommon. Faculty who attempt to improve reflective skills and practices must choose educational endeavors that facilitate development of such skills. Traditional lecture methods are not well supported as important in the development of reflective skills; therefore, other instructional methods have been explored and implemented.

Problem-based learning, featuring small-group learning and self-directed study, has been described as one possible method of promoting the development of reflection (Creedy & Hand, 1994; Heliker, 1994; Royeen, 1995; Graham, 1996; Solomon et al., 1996; Saarinen-Rahiika & Binkley, 1998; Vroman & MacRae, 1999). Other instructional methods believed to stimulate critical reflection include journaling, descriptions of critical incidents, critical discourse related to experiential learning, and critical questioning (Williams, 2001). Critical reflection, as an outcome of either PBL or a mixed-design curriculum, is difficult to quantify and study, and therefore is not a major focus of this study. However, in the qualitative portion of this study, the researcher examined the perceptions and reflections of the students at the end of their first year in the GVSU mixed-design PT curriculum.

The proposed four key outcomes of the PBL process--problem solving, CT, SDL (and the relationship to life-long learning), and critical reflection--have all been discussed, and relevant literature related to these topics has been reviewed. There is a need for further research that focuses on PT students to clarify the outcomes related to PBL and other methods used within a mixed-design curriculum.

Other Issues Related to PBL

Several issues related to PBL and its implementation are separate from the educational process and its outcomes. Implementation of a PBL course or curriculum is not equivalent to delivering content in a traditional manner. Several issues, including those related to students, faculty, and administration will be discussed.

Student Preparation and Satisfaction

Group work is required for participation in the PBL process. Peterson (1997) stated that problem solving and interpersonal skills are prerequisites for effective team work and that without adequate preparation of these skills, students attempting learning in such a method can become frustrated. Although most students who arrive at graduate programs are successful learners, they need to learn about the PBL process so that they are prepared for success within the new learning paradigm (Tavakol & Reicherter, 2003). Using developed skills and past experiences, students need to advance their ability to engage in a different type of learning within a group setting.

The disadvantages of the PBL approach described by students include anxiety about the process (Tavakol & Reicherter, 2003), additional time needed for searching for information, and difficulties in scheduling out-of-class group meetings. Students also described occasional personality conflicts within the group (Solomon et al., 1996). Most students report finding PBL “challenging, exciting, and enjoyable” (Tavakol & Reicherter, 2003, p. 113).

Faculty Preparation and Satisfaction

According to Baker (2000), faculty development is “mandatory” (p. 263) to prepare for teaching in PBL. Faculty development involves changes of perception and discussion of educational theory and outcomes related to PBL. Tenured and tenure-track faculty must be carefully prepared in areas such as philosophy and psychology of learning, case development, methodology (tutor/facilitator preparation), and evaluation skills in order to make the transition from traditional lecture/seminar-based instruction to PBL. Faculty must be able to introduce and reinforce PBL philosophy, concepts,

methods, and procedures successfully to students. Often, facilitators tend to be overly directive of tutorial groups, especially within their areas of expertise (Tavakol & Reicherter, 2003). Faculty must also alter their presentation of themselves as expert to that of a facilitator and guide throughout the PBL process (Miflin et al., 1999). Faculty must be offered support to allow them to change their conceptual beliefs about education (Creedy & Hand, 1994).

Consensus exists among educators experienced in PBL regarding the benefits experienced by students in the process. Educators state that students receive the greatest benefits from the PBL process when facilitators have expertise in PBL methodology and possess knowledge related to the subject of the PBL case (Tavakol & Reicherter, 2003). Although research suggests that participation in PBL, as an instructional method, is generally satisfactory for faculty (Albanese & Mitchell, 1993), careful faculty development, nurturing, and preparation are crucial to successful implementation of PBL within a mixed-design curriculum. If adjunct or nontenured faculty instruct within PBL courses as tutors and facilitators, their preparation and training is essential.

Administrative Issues

Implementation of a mixed-design curriculum that includes PBL methodology requires both understanding and support from the administration of the institution (Grand' Maison & Des Marchais, 1991; Baker, 2000; Tavakol & Reicherter, 2003) and the program leadership. No change to PBL methods within a curriculum can occur without a system's members' being willing to "give up old responses and learn new ones" (Bruhn, 1992, p. 168).

Although PBL may be a viable educational option, it may well be an “expensive innovation” (Albanese & Mitchell, 1993, p. 70). Increased instructional costs, increased needs for physical support, increased faculty and student time commitments, and increased requirements of support personnel must all be considered. Costs of faculty effort, in terms of time commitment in PBL appear to be no greater than effort for traditional instruction for class sizes of fewer than 40 and, perhaps, for class sizes up to 100 (Albanese & Mitchell, 1993). Faculty resources have been studied in several ways, and evidence does not entirely agree with the evaluation of Albanese and Mitchell (Mennin & Martinex-Burrola, 1986; Donner & Bickley, 1990). Although time commitment may be comparable between PBL and traditional instruction, PBL may demand different, more targeted investments of time to reach all groups. Costs rise for PBL instruction when additional faculty are hired to cover groups by serving as tutors or facilitators. Although there may be little financial difference in PBL versus traditional curriculum delivery, faculty time allocation or *face time* with students may be very different. Mennin and Martinez-Burrola (1986) studied weekly faculty contact with students and found that faculty in PBL curricula spent an average of 72% (20.6 hours) of their time with students as compared to those in traditional curricula, who spent 25-30% (8.6 hours). More time is spent by faculty in PBL tutorial groups as compared to time spent in traditional lecture. Donner and Bickley (1990) found that instruction in PBL programs required 17.4 faculty hours/year per student, compared to 4.8 faculty hours/year per student in traditional curricula. Although PBL appears to be cost effective in classes with fewer than 40 students, PBL may be “impractical for all but a few schools with class sizes greater than 100” (Donner & Bickley, 1990, p. 884).

Faculty need to be equipped for the reality of differing amounts of assigned time, as well as need to be compensated appropriately. The time commitment of faculty during the teaching and learning process has implications for a curriculum or program. To allow tenure-track and tenured faculty time for additional faculty duties, adjunct or nontenured faculty are often used as PBL tutors, but this practice adds to the departmental labor budget. The issues of faculty time and preparedness are important for understanding PBL, but these issues are not addressed in this study.

Space issues for PBL instruction are real. Much of PBL is performed in groups of 5-10 students that require tutors or facilitators and small meeting spaces. These small meeting spaces are much different than traditional classrooms (Royeen, 1995; Barrows, 1998; Baker, 2000). Having a number of small-group meeting spaces available for concurrent use may pose an additional administrative and cost issue compared to managing the same number of students in a traditional classroom.

Problem-based learning may also add to the requirements of the library in terms of learning resources such as periodicals, books, and other media, as well as access to librarian assistance (Baker, 2000). Students of PBL curricula show patterns of higher use of library resources (Nolte, Eller, & Ringel, 1988; Blumberg & Michael, 1992; Rankin, 1992) than students of traditional curricula. Multiple copies of certain texts, journals, and references may be needed. Certainly, abundant access to information, either written or web-based, is critical to success in the PBL process.

Support staff needs may also vary from those of traditional curricula. Secretarial staff demands may differ in terms of increased support for faculty who are spending more face time with students and therefore need more help with copying, typing, and other

organizational tasks. Like impact on faculty, library use and impact on support staff are not being studied directly in this research.

Teaching and Learning Issues

Teaching and learning are complex processes, not easily explained or described by numerical or descriptive data. Many factors influence learners' perceptions of and satisfaction with the learning process. Because learning is a highly personal activity, it is difficult to report on learner satisfaction within a group of subjects. Learning that occurs within a cohort or group makes it difficult to describe composite, general, or group learner satisfaction. Therefore, to make sense of students' perceptions, qualitative data, literature about the teaching and learning process, and learners must be described in relationship to this study.

Learning Styles and Learner Preferences

The belief that people learn differently dates back to ancient Greek philosophy. Ancient authors described "active, passive, thoughtful and emotional types" (Johns, 2001, p. 6). Although research on individual learner characteristics such as the intelligence quotient began in the 1900s, it was not until the late 1960s that significant descriptions of individual choices related to learning were described (Johns, 2001). Subsequently, a plethora of learning style inventories that attempt to describe individual learning differences and the preferences within an individual that drive and shape their learning has become available (Dunn & Dunn, 1993; Johns, 2001). Individuals possess unique characteristics and preferences for learning. Although individuals within a profession may display similarities in their primary learning styles, a flexible, adaptable style is

important for dealing with a variety of learning situations (Hayes & Allison, 1997; Linares, 1999; Dunn & Griggs, 2000).

Dunn and Dunn (1993) stated that “learning style is the way that students begin to concentrate on, process, internalize and remember new and different academic information” (p. 8). Learning style includes both biological and developmental components that make identical instructional settings, methods, and resources successful for some learners and not for others (Dunn & Griggs, 2000). Learning style has also been described as the various attributes or characteristics of a learner that, together with the learning environment, interact to produce learning outcomes (Payton, Hueter, & McDonald, 1979). Learning style, a composite of neural organization and personality, both influences and is influenced by the developmental and educational experiences of an individual (Hardigan, 1998).

Cognitive-style theory suggests that individuals deal with information with varied strategies based on learned or inherited traits (Dunn & Griggs, 2000). Previous research has investigated and described many variables related to learning style, including field dependence/independence, global/analytical, simultaneous/successive, and left/right hemispheric preference for information processing. Further discussion of exact learning styles and variables is not appropriate for this research, as neither were a primary focus during this investigation.

Most learners have identifiable learning style preferences. Learning preferences, one aspect of learning style, are described as the likes and dislikes of the learner for certain sensory modes and conditions of learning, as well as preferred strategies (Ostmoe, Van Hoozer, Scheffel, & Crowell, 1984). Researchers’ definitions of learning style

suggest that many differences exist in various learning style models (Dunn & Griggs, 2000). Because so many models for assessing and defining learning styles exist, none is described in detail herein. However, learning style models have been researched extensively, and an important outcome of that research is the focus on shifting instructional strategies from acceptable approaches for all learners to identification of strategies responsive to students with selected learning styles (Dunn & Griggs, 2000). Students with flexibility in learning style are likely to succeed in a variety of learning environments, whereas those with rigid learning styles will be less likely to adapt and succeed in varied environments (Delahousseye, 2002).

Several studies suggest that students in health occupation and nursing programs prefer concrete and teacher-oriented learning conditions (Garity, 1985; Linares, 1989; Rezler & French, 1975; Rezler & Rezmovic, 1981). Although learning style and preferences of this cohort of PT students were not assessed, the likelihood of a wide variety of learning styles and preferences being represented in this cohort cannot be dismissed. The variety of learning styles and preferences is important to the overall satisfaction a student reports about courses and a curriculum. Research suggests that when students' learning preferences match their instructors' teaching styles, motivation and performance improve (Miller, 2001; Stitt-Gohdes, 2003). However, few of the studies have examined adult learners. When individual learning preferences match course or performance expectations, scores are higher and conversely, when approach and expectations do not match, scores are lower (Delahoussaye, 2002). Hayes and Allison (1997) found that matched teaching/learning style is beneficial for educational performance of field-dependent vocational learners. Although PT may be considered a

profession rather than a vocation, as in many vocational training programs, PT classes are composed of students with varied learning style preferences. The disparity between learning style preferences within a group is summarized in the following quote:

Teaching exclusively to an individual's preferred style, if indeed it was possible, would undoubtedly be convenient and comfortable for the learner. But so much of what is involved in effective learning would be missing—having to struggle, taking a risk, picking yourself up after a setback and having another go, and learning from failure and mistakes. (Delahoussaye, 2002, p. 31)

Like satisfaction, the process of SDL is influenced by learning style, learning preferences, and personality traits. Self-direction in learning arises from both internal characteristics and external influences and demands (Brockett & Hiemstra, 1991). Preferred learning styles as well as personality characteristics are likely to serve as starting points for comfort with and utilization of SDL (Garity, 1985). Personal choice also plays a large role in self-direction during learning. An individual can learn in many modes but must choose a strategy and possess individual drive in order to be a successful self-directed learner. Ultimately, an individual is responsible for his or her own learning and therefore must accept the consequences of that learning. According to constructivist theory, even when learning in a self-directed mode, a student learns in a social context (Baxter Magolda, 1999; Fosnot, 2005). When chosen by or imposed upon learners, SDL does not happen in a vacuum. Students first pursue information independently on the bases of their individual processes for seeking facts and knowledge. Then, students often collaborate for completion of ideas, concepts, and processes in groups. PBL affords students such a learning construct.

The social context of the present study was either a traditional classroom, structured laboratory, or a PBL classroom where learners were divided into groups. The context for a learner provides an avenue for expansion of the learner's growth through SDL, PBL, or traditional methods. The larger social context for this study is the GVSU PT class of 2006 cohort, which was studied to glean information regarding perceptions and satisfaction with learning in traditional classroom, structured laboratory, or PBL classroom settings.

Faculty who facilitate adult learning should expect diversity among learners in learning preferences between learners and comfort with learning across situations (Ross-Gordon, 2003). Often, students' preferences for learning are not identified, nor are they be used to select instructional methods. Therefore, within a mixed-design curriculum, it is important to accept that learner preferences exist and acknowledge that such preferences affect learner satisfaction. Faculty must be flexible and fluid in their choices of methods and use of various methods. Instructors must be prepared and willing to make adjustments in expectations, levels of support, and instructional style to facilitate learning among learners of all styles and preferences.

Growth and Development

Each individual in an educational program is at a different developmental stage regardless of chronological age. Learners possess varied physical and psychological traits related to their development. Traditional learning theories emphasize the sequential, predictable, psychological development of learners (Ross-Gordon, 2003). Although normal or prescribed stages of biological and psychological development have been described related to age and autonomy, it is doubtful that all young adults who enter PT

professional schools are developmentally alike. Age-matched students could be assumed to be developmentally similar but in reality bring different experiences, varied personalities, and an array of preferences to the learning experience. Cognitive development continues well into adulthood (Kegan, 1994). The progression of each individual toward integration of all modes of learning and associated life skills varies (Kolb, 1984). Rather than providing educational experiences that keep learners at lower developmental levels, instructors should strive to provide experiences that allow for ongoing development and ever-increasing skills (Baxter-Magolda, 1999, 2001; Johns, 2001). This suggestion supports the mixed-design curriculum at GVSU and its varied and progressive methods.

Constructive-developmental theorists Baxter Magolda (1999), Kegan (1994), and Ross-Gordon (2003) emphasized the progressive development of learners toward more complex ways of thinking, understanding the self, and understanding the world. Constructive-developmental theorists focus on (a) progression of the ability of the learner to construct meaning and (b) the concurrent psychological development that occurs as learners become increasingly aware of themselves as knowledge constructors and problem solvers (Kegan, 1994). Construction of meaning and knowledge has not been directly correlated with developmental stage or chronological age. However, Migletti and Strange (1998) described an age-teaching style interaction that affected outcomes of courses in education classes. In their study, learner-centered instruction was associated with greater satisfaction in students older than twenty-five years. Conversely, adult college students have been reported as desiring more teacher-centered instruction. Some students reported mixed desires for availability, concern, flexibility of instructors, and

well-organized lectures (Ross-Gordon, 1991). Teacher-centered practices dominate higher education, and this fact may influence students' perceptions of alternate, more learner-centered practices (Ross-Gordon, 2003). Ross-Gordon (2003) asserted that it is important that educators seek course designs and instructional activities that are balanced between learner- and teacher-centered components in order to satisfy the mixed preferences and experiences of adult learners.

Tools for Outcome Assessment

Critical Thinking

The Watson-Glaser Critical Thinking Appraisal (WGCTA), first published in 1942, has an extensive research history and is often used in studies performed in educational settings. It has normative values and many validation studies. Several forms of this test exist, including the original Form A and Form S (short). Most analyses were performed on Form A, although equivalence between Form S and Form A (from which Form S is derived) is acceptable (Ivens, 1998). Form S is a shorter (takes about 30 minutes), more quickly administered, and updated version of the WGCTA. Reported overall reliability (coefficient alpha) is .81 for both internal consistency and test-retest reliability (Geisinger, 1998). A problem may exist with the use of the WGCTA, however. Because the WGCTA is a standard psychometric measure of CT, based upon assessment of CT in daily living rather than in clinical practice, it may be difficult to demonstrate change in critical thinking in health professions students. Studies using standard psychometric measures of critical thinking have shown nonsignificant results in development of CT and problem solving in nursing, OT, and PT students (Slaughter et al., 1989; Vroman & MacRae, 1999; Daley et al., 1999; Wilson, 2000). Each of these studies differed in the

researcher's use of the WGCTA from the present research in several ways: change attributable to clinical education (Slaughter, et al., 1989), time of intervention, and use with undergraduate students of various disciplines. In summary, the WGCTA is a short, practical measure of critical thinking that has been used minimally with PT students. It is frequently described as being the "gold standard" for assessment of critical thinking. Therefore, despite its potential shortcomings, it was the best test available for measuring entry-level CT skills and their development over the first year of a mixed PT curriculum.

Self-Directed Learning

Only one test of SDL readiness, the Self-Directed Learning Readiness Scale (SDLRS-A), was found. It was developed by Guglielmino (1978) at the University of Georgia for her dissertation research. The SDLRS-A (A denotes the adult version) uses a 58-item, five-point Likert scale that measures a total score for SDL readiness. The instrument is described to subjects as a tool to gather data on learning preferences and attitudes to avoid possible response bias either toward or against SDL (Linares, 1999). Guglielmino (2000) stated that the SDLRS-A is the most widely used instrument for the assessment of readiness for self-directed learning. Guglielmino's dissertation (1978) reported the Cronbach-alpha reliability coefficient of .87. An analysis of 3,151 SDLRS test scores demonstrated a Pearson split-half reliability estimate of 0.94 (McCune, Guglielmino, & Garcia, 1990). Construct, internal, and predictive validity have been established and are supported by literature searches and use of expert opinion (McCune et al., 1990; Brockett & Hiemstra, 1991). A meta-analysis of 29 studies that used the SDLRS provided further evidence of validity, demonstrating positive associations with autonomy, self-directed learning activities, and an orientation toward personal growth

(Guglielmino, 1989). Walker (2001) used this assessment to determine the effect of a PBL curriculum on pharmacy students' perceptions of SDL over a 16-week academic semester. The SDLRS is the best available standardized test for studying PT students' perceptions about SDL in the first year of a mixed curriculum.

Studies involving nursing students or practicing nurses generally report higher mean self-directed learning-readiness scores than those reported by Guglielmino (1978) for adults in the general population (Linares, 1999). Linares (1999) reported that 38.7% (12) of PT students (n = 31) were in the high-score range, 38.7% (12) in the average-score range, and 22.6 % (7) in the low-score range. Because individual scores and the average score for the PT students in the Linares (1999) study were not available, comparison to the mean SDLRS score for adults in general was not possible.

Theoretic Framework and Summary

The theoretical framework for the present research centers around instructional methods that are embedded within a mixed-design curriculum used to educate PT students. This conceptual framework is represented graphically in Appendix G. These instructional methods are both traditional and nontraditional, and both are used within the context of the mixed-design curriculum at GVSU. The development of the GVSU mixed-design curriculum and the selection of methods used in the first year of the curriculum are based on adult learning and constructive-developmental theories. The outcomes desired of the students of the GVSU PT program are varied, but those being assessed in the present research are CT and SDL, as well as students' perceptions of their learning experiences.

One of the key components in the GVSU PT curriculum is the focus on instruction to enhance problem solving and critical thinking. Although both constructs are important, this study only assessed CT as an outcome of the first year of instruction. The faculty of the GVSU PT program seek not only to prepare PT students for the practice arena of today but also to prepare them to adapt and grow with ever changing practice patterns and evidence related to PT. In short, the faculty seek to produce critical thinkers who are also life-long learners.

This research was designed to explore the experiences and performance of a cohort of students within the first curricular year of the GVSU PT program. Because little is known about the outcomes of CT and SDL and their development throughout PT curricula, this study seeks to expand the evidence about such topics.

Likewise, research has not conclusively established the role of PBL in education of allied health, nursing, or medical students. Therefore, this study used both quantitative and qualitative research methods to determine performance on standardized tests and perceptions about the curriculum found within the subjects. This study will likely serve as a catalyst for future research in the area of curriculum, teaching methods, development of desirable characteristics in PT students, and educational theory.

CHAPTER 3: METHODOLOGY

The proposal for this study was reviewed by the Human Subjects Institutional Review Board (IRB) of Eastern Michigan University, and approval to proceed with the study was granted (see Appendix D). Renewal and extension of approval for the study from the same board were received to allow for finishing data collection after the first year.

Research Design

This project was a mixed-method (Johnson & Onwuegbuzie, 2004), cross-sectional, explanatory field study (Johnson, 2001). This action research and evaluation employed both quantitative and qualitative data collection and used a convenience sample without a control group. The research was performed in the researcher's own institution and program. The research was designed so that the researcher could study the influence of the mixed-design curriculum of the GVSU PT program on the GVSU PT students throughout their first year. The first-year GVSU PT curriculum is composed of 15 required courses and one optional course that vary in instructional methodology (see Appendix A). All PT students must progress through the PT curriculum in a lock-step manner, meaning that failure to complete all required courses successfully would prevent a student from progressing to the second year of the curriculum. All students in the cohort being studied were taught the same courses, in a prescribed order, by the same instructors.

Therefore, the two standardized tests (the SDLRS-A and the WGCTA), the end-of course evaluations, and the additional questionnaires' numerical results were analyzed quantitatively. Pre- and posttest data were compared, and differences were identified and analyzed. Likewise, end-of course evaluations and questionnaires were compared

between courses that are PBL in nature and those that are delivered in traditional instructional methods. It is important to determine whether there were statistically significant differences between pre- and posttest performance on the standardized tests of SDL and CT that occur following the first year of the GVSU PT mixed-design curriculum. Also, it was important to determine if there were statistically significant differences between outcomes of courses delivered by different education methods. Numerical evaluations (both end-of course and questionnaires) provided an objective comparison of student perceptions and satisfaction with courses throughout the first year of the curriculum.

Although this study used quantitative methodology for some data collection and statistical analyses, positivistic realism alone does not allow for the thoughtfulness, humanistic perspective, and depth required for an analysis of student perceptions related to their experiences in the first-year GVSU PT curriculum. Qualitative methods were used to study student perceptions and opinions in order to provide insight into their first-year experience.

Subjects and Subject Recruitment

All PT students admitted to the GVSU-PT class of 2006 (N = 43) were solicited to participate as subjects in this study. They were recruited by word of mouth, and all participated on a volunteer basis. The inclusion criterion was admission to the GVSU PT class of 2006. To remain a part of the study for its entirety, a student had to maintain good academic standing by earning a minimum of a B- in all PT courses and a minimum of C+ in health sciences courses taken throughout the first-year curriculum. Students

were also required to complete their first clinical education placements successfully, which were graded on a credit/no credit basis.

One student failed to complete the first three semesters in good academic standing and was dropped from the study. One student withdrew from the curriculum in the second semester because of personal reasons and was also dropped from the study. Data gathered on the 41 subjects who did progress through the first year of the GVSU PT curriculum in good academic standing were included in the final analysis.

Can the subjects of this study be considered adult learners? Although no rigid definition of an adult learner exists, most would consider a young person over the age of 21 to be adult in societal terms. Many would assume that an individual who attends college, university, or graduate school is an adult and, therefore, an adult learner. Of the GVSU PT students admitted to the class of 2006, the majority had completed a bachelor's degree upon entry to the program. Many of these students lived independently, either with roommates or significant others, and would be considered adults for practical purposes.

The researcher assumed that although PT students enrolled in the GVSU PT program would be categorized as adults, they do not always function as typical adult learners. Davis (1993) suggested that traditional college-age students, 18-25 years old, be considered young adults. The average age of the GVSU PT student upon admission to the program is 22 to 25 years old (GVSU, 2003). Therefore, the majority of students in the current study may be better described as young adult learners than as adult learners. As young adult learners, PT students retain some characteristics of adolescent/child learners and have not fully assimilated all the characteristics of adult learning. Therefore, students

such as those in the GVSU PT program warrant observation and study of their learning behaviors and the development of these behaviors. Demographic data including gender, age, and whether the students had completed a bachelor's Degree upon entry to the program were collected and are further described in chapter 4 and were used in data analyses.

Instruments

Guglielmino's (1978) SDLRS-A was used to assess the students' SDL readiness. As described previously, Guglielmino originally reported the reliability estimate for the SDLRS as .87. An additional analysis of 3,151 SDLRS test scores demonstrated a Pearson split-half reliability estimate of 0.94 (Guglielmino, 1989). Furthermore, a meta-analysis of 29 studies that used the SDLRS provided evidence of validity, demonstrating positive associations with autonomy, self-directed learning activities and an orientation toward personal growth (Guglielmino, 1989). Construct validity for the SDLRS-A has also been established (Brockett & Hiemstra, 1991). The WGCTA, developed by Watson and Glaser (1980), was used to assess the students' CT. Reported overall reliability (coefficient alpha) for the WGCTA is .81 for both internal consistency and test-retest reliability (Geisinger, 1998). Validity of the WGCTA has been established for general constructs of CT (Watson & Glaser, 1980, 1994) rather than for CT in health professionals or health professions students.

Additional quantitative data were gleaned from end-of-course evaluations from all first-year PT courses. Standard GVSU forms and protocol for end-of-course evaluations were used. Additional quantitative data were gathered from written questionnaires used with course evaluations (Appendix B) after second-semester PT courses.

Qualitative data were gathered via focus groups. Structured-oral-interview focus groups of 8-12 students were conducted (Appendix C) after third-semester courses (end of the first curricular year). The additional questionnaire and focus group questions were developed with the assistance of an experienced qualitative researcher, providing face validity. The purpose of the course evaluations, additional written questions, and the oral interviews/focus groups was to obtain quantitative and qualitative data regarding student satisfaction with and perceptions of the first-year GVSU mixed-design PT curriculum.

Procedures

Data collection began after the IRB of Eastern Michigan University granted permission to conduct the study. Students were recruited by verbal request of the researcher. The standardized tests and all of their forms, instructions for administration, and instructions for scoring were obtained from the tests' distribution companies. The SDLRS-A was obtained from Guglielmino and Associates (7339 Reserve Creek Drive, Port St. Lucie, FL, 34986), and the WGCTA from The Psychological Corporation® (19500 Bulverde Rd., San Antonio, TX, 78259).

The initial data were collected within the first two weeks of the start of the program and subsequently labeled *pretest*. At the outset, the purpose, procedure, and confidentiality of identity were explained verbally, and subjects were assured that any quotes used in final qualitative data reporting and analyses would be anonymous. Each subject then signed an informed consent statement (Appendix E), completed demographic information, and received the pretest administration of both the SDLRS-A and the WGCTA. Both tests were administered with standard instructions provided by the test authors and without time limitations. The two standardized tests, the SDLRS-A

and the WGCTA, were readministered in the final week of the third semester and subsequently labeled *posttest*. The timing of the posttest administration corresponded with the end of the first year of the curriculum, encompassing approximately 42 weeks of instruction. At this point, students had completed the first of three years of the MSPT professional program.

Student satisfaction with the teaching and learning process is difficult to understand and explain. Many variables can and do affect student perception of and satisfaction with courses and educational techniques. Therefore, multiple sources of information regarding student satisfaction and perceptions were used to attempt to describe and understand the perceptions of the PT cohort being studied. These included quantitative data from the WGCTA, the SDLRS-A, and end-of-course and additional questionnaires as well as qualitative data gleaned from focus group interactions.

Course evaluations from the first year of the PT curriculum (Appendix A) as well as a short, appended questionnaire (Appendix B) were used to obtain numerical data regarding student satisfaction. Because GVSU institutional end-of-course evaluations were not designed to measure satisfaction and perceptions, the additional questionnaire was developed with the assistance of an experienced qualitative researcher. The appended questionnaire consisted of six simple questions in Likert format (Appendix B), which was constructed to assess the comfort and satisfaction of the learners with the teaching and learning methods used in courses. To establish content validity and clarity, the questions were first examined by an experienced qualitative researcher, then given to PT students who were not in the sample cohort as a pilot exercise. Revisions were made on the basis of comments offered by students, and the final versions of questions were

used in the appended questionnaire for this study. Three open-ended questions were originally developed as a part of the appended questionnaire. Based on comments and incomplete answers received during the pilot test of the questions, the open-ended questions were determined to be more appropriate for focus groups rather than as a part of the written questionnaire. Therefore, the open-ended questions were revised and adapted for use as focus group questions (Appendix C).

To explore and triangulate quantitative, written-questionnaire data, the researcher gave students the opportunity to express themselves orally in focus groups, in which preconstructed questions provided opportunity for discussion about students' satisfaction with the curriculum and specific methods that matched or did not match their self-described learning styles. Students were asked to sign up for a focus group time that fit into their schedules. At the conclusion of semester three, during July and August 2004, five focus groups, each comprising 8-12 students, were convened. Focus groups were conducted by the researcher. The qualitative, open-ended, opinion-based questions were designed to help the researcher obtain deeper understanding of the perceptions of the students enrolled in the first year of the GVSU PT curriculum. Qualitative data obtained from each focus group interview were transcribed (removing all personal references), and comments were separated and placed on note cards. Further sorting and theme identification prepared the data for analysis.

Demographic data were gathered from study participants at their pretest session. These data were entered on SPSS 12.0. All standardized tests were scored with the use of rubrics provided by their authors, and all data were also entered on SPSS 12.0. Numerical

scores from course evaluations and additional questionnaires were analyzed and grouped by PBL and non-PBL methods of course delivery and were recorded in SPSS.

Quantitative Data Analysis

Descriptive summary data including frequency counts, percentages, distribution, and measures of central tendency appropriate to the type of data were used to describe and analyze demographics of the subjects (gender, age, and achievement of bachelor's degree prior to starting the PT program). The demographic data were cross-referenced with the same data for the classes of 2004 and 2005 to identify similarities between the class of 2006 and the two classes of students that preceded them. Descriptive results from the WGCTA, SDLRS-A, end-of course evaluations, and questionnaire items were also reported.

T tests for related samples were used to examine the differences between mean pre- and posttest scores for the SDLRS and the WGCTA. The differences between WGCTA and SDLRS-A pre- and posttests were calculated, and a two-way ANOVA was used to determine whether gender or degree status was statistically related to mean performance. Kendall's Tau correlation statistic was used to determine whether relationships existed between age and mean differences on the WGCTA and the SDLRS-A. Discriminant analysis was used to compare end-of-course question scores and scores for the additional questionnaire items to determine whether differences existed by type of course (traditional vs. nontraditional). SPSS for Windows, version 12.0, was used for descriptive and statistical analysis, with a 0.05 probability level used to determine statistically significant differences.

Qualitative Data Analysis

Qualitative research differs from quantitative research in several ways that can be described as *trustworthiness*. Trustworthiness is established in qualitative research through four criteria: credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). These four criteria are synonymous with internal validity, external validity, reliability, and objectivity, respectively, in quantitative research.

Credibility represents the truth value of a qualitative study. To satisfy the credibility criterion, there must be confidence in the truth of the findings of the research (Lincoln & Guba, 1985). To satisfy credibility, the current study used strict procedures for the administration of multiple focus groups. Predetermined questions were read from a script to ensure that all participants were asked the same questions. Similar probing questions without suggestions were used by the researcher during focus groups to elicit answers of depth.

Transferability refers to the applicability of a study. The findings of research must be applicable in other contexts or with other subjects to fulfill the transferability criterion (Lincoln & Guba, 1985). An entire class of PT students was used in this study. Students in the GVSU PT program are educated as a cohort, and the cohort used for this study was compared to two classes before them for similarity of GPA on admittance, age, and distribution of sexes. However, the gender distribution of the cohort being studied was slightly different. No attempt was made to establish transferability to other PT programs.

Dependability refers to the consistency of a study. To achieve the dependability criterion, the research findings must be the same if the study is repeated with similar or same participants in similar or same contexts. Dependability can also be described as the accuracy of the study (Lincoln & Guba, 1985).

Confirmability refers to the neutrality of a study. Neutrality explains the degree to which the research findings are determined by the subjects and the conditions rather than by inquirer bias or perspective (Lincoln & Guba, 1985). Confirmability in the current study was initiated during transcription of data, when all identifying names were removed to prevent identification of the contributors, thus diminishing possible researcher bias. Confirmability was also addressed by conscious neutral-perspective self-reminders by the researcher and use of only prescribed questions during focus group discussions. Finally, assistance was provided during qualitative data coding and analysis by an additional, neutral researcher. This experienced qualitative researcher assisted with sorting of data, establishment of themes, descriptions of trends, and drawing of conclusions from the qualitative data.

Results of the present study are presented in several sections of chapter 4. These sections include a presentation of demographic data, results of both of the quantitative tests, detailed data analysis procedures, and an interpretation of quantitative and qualitative data.

CHAPTER 4: PRESENTATION AND ANALYSIS OF DATA

The GVSU PT students were studied over the first of a three-year, mixed-design, professional PT curriculum. During this first year, the students moved as a cohort through a designated sequence of courses that were taught by various instructors who used varying instructional methodologies. At the conclusion of the first year, the students completed the previously described quantitative and qualitative assessments for evaluation of their performance and perceptions.

The techniques of data analysis, the demographic and descriptive information about the sample, and the statistical and qualitative analysis of the data from the current study are presented in chapter 4. The results are reported to allow for further discussion in chapter 5.

Techniques of Data Analysis

Pre- and posttest quantitative assessments (WGCTA and SDLRS-A), end-of-course evaluations, and additional questionnaires were completed by the students of the GVSU PT class of 2006 during their first curricular year. Focus group interviews were completed with all students in the summer of 2004 at the conclusion of the first curricular year. Ensuing data analysis consisted of both quantitative and qualitative techniques. Quantitative analyses consisted of frequencies, paired *t* tests, analysis of variance, cluster analysis, Pearson's correlation coefficient, and Kendall's Tau correlation. Quantitative analysis was used to determine significance of, relationships between, and grouping of numerical data from the quantitative tests, evaluations, and questionnaires. Open, axial, and selective coding were used to analyze qualitative data. (Strauss, 1987). Qualitative analysis provided meaningfulness and the ability to expound upon the numerical data and

explain the thoughts and feelings (Miles & Huberman, 1994) of the students about their experiences during the first year of the PT curriculum.

Demographic Data

First-year physical therapy students (n = 41) who were enrolled in the GVSU PT program and completed the first year in good academic status participated in the study and were included in descriptive and statistical analysis. Two subjects were dropped from the study during its yearlong course; one student dropped out due to insufficient grades, and another discontinued the program for personal reasons; neither was included in the statistical analysis. The students' ages ranged from 20 to 34 years old, with an average age of 22.8 years. Thirty students (73.2%) were female, and 11 (26.8%) were male. Twenty-two (53.7%) had completed a baccalaureate degree prior to beginning the PT program; (46.3%) had not. Those who had entered the PT program with an incomplete baccalaureate degree completed it within the first academic year of the PT program. See Table 1 for frequencies and percents regarding the subjects' ages, gender, and degree completion status.

Table 1

Descriptive Data for Subjects*

Age (years)	Frequency (n)	Percent (%)
20	3	7.3
21	9	22.0
22	14	34.1
23	7	17.1
24	3	7.3
26	1	2.4
27	2	4.9
30	1	2.4
34	1	2.4
Gender		
Male	11	27
Female	30	73
Degree status at start		
No Degree	19	46
Degree	22	54

* N = 41, although 43 students were admitted. Two were dropped from the study because they dropped out of the PT class of 2006 for academic or personal reasons.

To demonstrate similarity between the 2006 GVSU PT class and others before it, demographic data between classes were examined. Comparability was established with two other GVSU PT student cohorts (the classes of 2005 and 2004), as age and GPA at admission were similar.

Table 2

Comparison of GVSU Physical Therapy Class Cohorts of 2004-2006

Class cohort (grad. year)	Students admitted (N)	Age at admission	Male n (%)	Female n (%)	GPA at admission
2004	48	23.33	9(19%)	37(81%)	3.5
2005	45	22.86	8(18%)	37(82%)	3.41
2006	43	22.89	11(26%)	32(74%)	3.44

Descriptive Data

The WGCTA pretest scores for subjects (n = 43) ranged from 19 to 39, with perfect score's being 40. The average WGCTA pretest score was 30.44 (standard deviation = 5.06). The WGCTA posttest scores (n = 41) ranged from 21 to 39, the average score's being 31.59 (standard deviation = 4.86).

The subjects' (n = 41) SDLRS-A pretest scores ranged from 186 to 251, with an average of 224.02 (standard deviation = 17.587). Guglielmino (1978) reported the average score for adults to be 214 with a standard deviation of 25.59. Table 3 lists Guglielmino's descriptive categories of self-directed learning readiness as published in the test administration and interpretation manual. Below-average to above-average scores on pretests were attained by GVSU PT students; their mean score (224.02) fell into the average category as described by Guglielmino (2000).

Table 3

Guglielmino's Descriptions of Self-Directed Learning Readiness Based Upon SDLRS-A Scores

Test score	Readiness for self-directed learning
58-176	Low
177-201	Below average
202-226	Average
227-251	Above average
252-290	High

The SDLRS-A posttest scores (n = 41) ranged from 175 to 266, with an average score of 219.68 (standard deviation = 21.191). GVSU PT students' posttest scores ranged from the below-average to high categories, with the mean score's (219.68) remaining in the average category.

Standard GVSU end-of-course evaluations were examined for all PT classes offered in the first curricular year. Six questions were selected for use in the data analysis of this study. The GVSU standard end-of-course evaluation consists of 34 questions used to gain insight into multiple aspects of a course, as well as into instructor performance. Questions were chosen for use in this research if they related to learner satisfaction, teaching methods and techniques, or teaching style. Questions that were statistically examined in the current research are shown in Table 4. These questions were used as indicators of student satisfaction with PT courses offered within the first year.

Table 4

End-of-Course Questions used for Data Analysis (Appendix D)

End-of-course	Question
question number	
14	I enjoyed taking this course.
16	This instructor used a variety of effective methods and teaching techniques to promote learning.
18	This instructor used effective questioning and discussion skills that stimulated my thinking.
20	This instructor used appropriate analogies and examples to explain important concepts and terms.
23	This instructor used a teaching style that kept my attention throughout this course.
34	This instructor was flexible and willing to adjust the pace and teaching style if necessary.

Numerical scores for each question were gleaned from recorded copies of end-of-course evaluations provided by the PT department secretary. Students answered all end-of-course evaluation questions, using a 1-5 Likert-type response in which a score of 1 indicated Strongly Agree, 2 indicated Agree, 3 indicated Neither Agree nor Disagree, 4 indicated Disagree, and 5 indicated Strongly Disagree. For each question examined in

this research, a lower score, closer to a score of 1 would be the best score and indicate agreement with the statement. Therefore, higher scores indicate less agreement with the statement and likely less satisfaction with the course, the methods or techniques used during the course, or teaching style of the instructor. Table 5 shows the mean scores for each question for each PT course offered in the first curricular year. Average ratings for courses show the highest satisfaction with PT 418 and PT 421, the lowest satisfaction in PT 481 and PT 482, and intermediate satisfaction with PT 408, PT 420, PT 422, and PT 425.

Table 5

*Numerical Scores on Selected End-of-Course Questions by PT Course**

Question number	PT 418	PT 481	PT408	PT 420	PT 421	PT 422	PT425	PT 482
14	1.55	2.79	3.42	2.00	1.68	2.67	2.39	3.16
16	1.60	2.79	2.63	2.14	1.66	2.64	2.22	3.16
18	1.62	2.78	2.32	1.96	1.56	2.31	2.58	2.37
20	1.43	2.83	1.91	1.93	1.59	2.10	2.35	2.47
23	1.93	2.99	3.42	2.18	1.73	3.31	2.51	3.29
34	2.07	3.29	2.27	2.40	1.85	2.83	2.73	2.90
Average	1.70	2.91	2.66	2.10	1.68	2.64	2.46	2.89

*Refer to Appendix A for course designation.

In an additional questionnaire prepared by the researcher (see Appendix B), students identified the teaching methodology used in courses and answered questions

relating to their ability to master content, enjoyment of teaching methods, and preparation for teaching methods. The additional questionnaire was piloted in one first-semester PT course and then administered after all second-semester courses of the PT curriculum. Students answered the additional questions, using the same 1-5 Likert-type responses described for the end-of-course evaluations. Question number 6 was worded negatively to serve as a double check of the other four questions and to ensure that students did not randomly choose the same number to answer all questions. The five additional questions used in the questionnaire are shown in Table 6.

Table 6

Additional Questionnaire Numbers and Wording for Use After Semester 2

Question number on questionnaire	Question wording
3	The teaching methods used in this course to deliver content helped me master the course content.
4	I enjoy learning in the modes/methods used in this course.
5	The teaching methods used in this course were my favorite.
6	I am uncomfortable with the teaching method(s) used in this course.
7	I am prepared to handle the type of instruction I have encountered in this course.

Table 7 describes the method of teaching and learning identified for each class and the mean answers for each question for the PT semester-long courses. Questions 1 and 2 were related to identification of methods for the course and involved circling the

one best answer that described the teaching methodology used in classroom (Question 1) and laboratory sessions (Question 2). Questions 3, 4, 5, and 7 were positively worded, meaning that a lower numerical score is best and indicates agreement with the statement.

In contrast, question 6 is negatively worded; thus, a higher numerical score is best and indicates disagreement with the statement. Using both a positive statement (Question 4) and a negative statement (Question 6), at the suggestion of the qualitative research expert, facilitated understanding the students' perceptions of teaching methods. This strategy served as a double check of students to be sure that they were reading questions carefully and not just selecting a random number for a score. To ensure that students responded accurately to question 6, all questionnaires were analyzed visually. Student answers to question 6 were found to be discriminating because they showed a reversal of numerical scores when compared to the positively worded questions. Note that Table 7 averages for courses were calculated through inversion of the scores from question 6, as using those as scored would have altered the average inappropriately toward a higher degree of disagreement with positive statements.

Subjects appeared to be most satisfied with their content mastery ability, comfortable with teaching methods, and prepared to handle instruction in PT 421 and least comfortable with same conditions in PT 482. Subjects were most likely to agree with the statements "I enjoy learning in the modes/methods used in this course" and "The teaching methods used in this course were my favorite" and most prepared to "handle the type of instruction" in reference to PT 421, a largely lecture and case-based laboratory course. PT 482 was the only PBL course (as identified by students) in the first year. Subjects were most likely to disagree with the statement that "the teaching methods in

this course helped me to master content” and agreed with the statement “I am uncomfortable with the teaching method(s) used in this course” in reference to PT 482.

Table 7

Course Methods Designations and Mean Answers for Second-Semester PT Courses

Derived from Additional Questionnaire Questions

Course	Teaching methodology	Q #3	Q #4	Q #5	Q #6*	Q #7	Average score
PT 418	Lecture, Hands-on lab	2.07	2.00	2.53	3.80 (2.21)	1.90	2.14
PT 420	Case-based, Hands-on lab	2.65	2.28	3.05	3.4 (2.60)	2.08	2.53
PT 421	Lecture, Lecture- discussion; Case- based	1.84	1.68	2.35	3.76 (2.24)	1.81	1.98
PT 422	Lecture, Hands- on lab	2.81	2.61	3.34	3.49 (2.51)	2.15	2.68
PT 425	Lecture	3.21	2.44	3.37	3.33 (2.67)	2.93	2.92
PT 482	Problem-based	3.41	3.19	3.91	3.00 (2.69)	2.84	3.21

* Negatively worded question; larger number represents higher degree of disagreement with the statement. Reported in the table as an inverted score, with actual score below in parentheses.

Statistical Analysis

Initially, paired sample *t* tests were used to examine potential differences in group means for the pre- and posttest WGCTA and the SDLRS-A. The WGCTA pretest and posttest means demonstrated a statistically significant difference ($p = .05$), and the SDLRS-A pre- and posttest means approached a statistically significant difference ($p = .06$).

For additional analysis, differences between pre- and posttest mean scores for the WGCTA and the SDLRS-A were computed. Table 8 illustrates the pre- and posttest differences in scores data for both the WGCTA and SDLRS-A.

Table 8

Descriptive Statistics for Differences in Pre- and Posttest Performance on the WGCTA (CT) and SDLRS-A (SDL)

	N	Range	Min	Max	Mean	SD	Variance
CTdiff	41	15.00	-7.00	8.00	1.07	3.41	11.62
SDLdiff	41	92.00	-45.00	47.00	-4.63	15.28	233.49
Valid N (listwise)	41						

Subjects' ($n = 41$) posttest scores on the WGCTA differed from their pretest scores by a mean of 1.07 points (standard deviation = 3.41); the range was from -7 points, indicating a poorer test performance, to + 8 points, indicating improvement on the test. On the SDLRS-A, subjects' posttest scores differed from their pretest scores by a mean

of -4.63 points (standard deviation = 15.28), indicating an overall decline in performance on the test. Changes in mean performance on SDLRS-A test performance ranged from 45 points worse to 47 points better.

Overall, subjects improved on the WGCTA by approximately one point, which is statistically significant. Although statistically significant, the change of one point is not considered practically significant and will be discussed further in chapter 5. These results suggest minimal-to-no change in CT abilities as measured by the WGCTA. Subjects performed less well on the posttest administration of the SDLRS-A than on the pretest administration of the same test, which suggests less affinity for self-directed learning behaviors at the completion of the first curricular year.

The Pearson product-moment correlation was used to analyze the relationships between pre- and posttest scores were analyzed for both the WGCTA and the SDLRS-A, and they were found to be statistically correlated (WGCTA: $r = .77$, $p = .00$; SDLRS-A: $r = .71$, $p = .00$), as was expected. Correlations between the WGCTA and SDLRS-A pretest scores and the posttest scores of the same tests were low and not statistically significant. This finding demonstrates that the scores on the two quantitative tests used in this research are not statistically related. The pre- and posttest correlations between the mean scores on the two quantitative tests are summarized in Table 9.

Table 9

Correlations between Mean Scores on the WGCTA and SDLRS-A (Pre and Post)

Correlated mean scores	N	r value	p value
Pre- WGCTA vs. SDLRS-A	41	.29	.06
Post- WGCTA vs. SDLRS-A	41	.20	.20

A two-way ANOVA was used to analyze mean changes in CT scores on the WGCTA in order to determine whether any difference in scores could be explained by gender or degree completion (Table 10). Neither gender ($p = .81$) nor degree status ($p = .68$) was determined as contributing to mean change scores for CT.

A two-way ANOVA was used to analyze mean changes in SDL scores on the SDLRS-A in order to determine whether any difference in scores could be explained by gender or degree completion (Table 11). Again, neither gender ($p = .29$) nor degree status ($p = .96$) was determined as contributing to mean change scores for SDL.

Table 10

Two-Way ANOVA Differences Between Mean-Change Scores on the WGCTA by Gender or Degree Completion (Dependent Variable: CTdiff)

Source	df	F	Type III sum of squares	Mean square	Sig
Tests of between-subjects effects					
Corrected model	3	.153	5.685 ^a	1.895	.93
Intercept	1	2.683	33.296	33.296	.11
Gender	1	.058	.717	.717	.81
Degree	1	.179	2.221	2.221	.68
Gender * degree	1	.278	3.451	3.451	.60
Error	37		459.095	12.408	
Total	41		512.000		
Corrected total	40		464.780		

^a R Squared = .012 (Adjusted R Squared = -.068)

Table 11

Two-Way ANOVA for Differences Between Mean-Change Scores on the SDLRS-A by Gender or Degree Completion (Dependent Variable: SDLdiff)

Source	df	F	Type III sum of squares	Mean square	Sig
Tests of between-subjects effects					
Corrected model	3	.428	312.988 ^a	104.329	.73
Intercept	1	4.698	1146.074	1146.074	.04
Gender	1	1.151	280.880	280.880	.29
Degree	1	.003	.631	.631	.96
Gender * degree	1	.173	42.151	42.151	.68
Error	37		9026.524	243.960	
Total	41		10220.000		
Corrected total	40		9339.512		

^a R Squared = .034 (Adjusted R Squared = -.045).

Kendall's Tau correlations were used to determine whether mean performance differences on the WGCTA and SDLRS-A were related to age. A nonparametric test was chosen because the age variable was not normally distributed. Neither test demonstrated strong or statistically significant correlations to age (see Table 12).

Table 12

Correlation Between Age and Performance on the WGCTA and SDLRS-A

Test	N	r value	p value
WGCTA	41	-.11	.36
SDLRS-A	41	-.12	.32

Finally, to expound upon the descriptive visual analysis provided earlier in Tables 5 and 7, cluster analysis was performed on the numerical scores from the end-of-course questions and the numerical scores on the additional questionnaire to place similar courses into a cluster or group. The mean scores for end-of-course evaluations and questionnaire responses were converted to z-scores, or standardized scores, thereby placing all questions on a common footing by finding the relative difference between classes for any given question. Z-scores were then used to place the PT courses examined using the end-of-course and additional questionnaire questions into clusters whose values on the questions were similar. Courses were placed in clusters on the basis of six-dimensional vectors, and the cluster analysis, which formalized the intuitive approach to examining vectors, determined *similar* by taking a measure of the distance between the vectors for each course and a cluster center, a vector used as a reference for the data.

Using end-of-course evaluations, I grouped the ten courses examined (by these evaluations) into two clusters: Cluster One, corresponding to courses that received positive evaluations, and Cluster Two, corresponding to courses that received less positive evaluations. Cluster One comprised PT 418, PT 420, PT 421, and HS 461, and Cluster Two comprised PT 481, PT 408, PT 422, PT 425, PT 482, and HS 427. The

courses contained in Cluster One (more positive scores) were split between traditional (PT 418 and HS 461) and nontraditional (PT 420 and PT 421) teaching methods.

Likewise, the classes in Cluster Two (less positive scores) were split equally between traditional (PT 422, PT 425, and HS 427) and nontraditional methods (PT 481, PT 408, and PT 482).

I placed the six courses examined (by these questionnaires) in clusters, using the additional questionnaires. Again, Cluster One corresponds to courses that received favorable evaluations, and Cluster Two corresponds to courses that received less favorable evaluations. Cluster One comprised PT 418, PT 420, and PT 421. Cluster Two comprised PT 422, PT 425, and PT 482. The cluster memberships are the same for the six courses for which both end-of-course evaluation data and additional questionnaire data were available.

Qualitative Data Analysis

The conversion of audio-taped responses to questions asked during focus groups (see Appendix C) to written transcripts began the process of qualitative data analysis. Through adherence to strict procedural guidelines during focus-group interviews, dependability was achieved in the current study. To ensure completeness and accuracy of all transcribed data, the researcher then cross-referenced the typed transcripts to the audiotapes in order to clarify areas of ambiguity or to answer questions posed by the transcriptionist. The typed transcripts were then cut into paper strips on the basis of discrete thoughts or ideas and placed on index cards.

An initial sort seeking patterns and trends in language and thoughts, also known as the *open coding process*, was performed. A second sort, known as *axial coding* was

performed, and 12 themes were identified. A third sort was performed that narrowed the general themes into three main themes, each containing several subthemes. This final sort is known as *selective coding*. Themes and subthemes were evaluated by an experienced qualitative researcher to ensure that responses had been sorted appropriately and outliers had been set aside, and to limit bias. The themes and subthemes were subsequently named, color-coded on the index cards, and operationally defined. A code book was created to outline the themes and subthemes. The themes were then linguistically analyzed for representative responses that characterized each theme as a whole. Broad counts were established for the numbers of comments in themes and subthemes, as well as for whether the comments were positive or negative in nature.

Three main themes emerged, and the subjects' responses were divided into those themes: (a) teaching and learning processes, (b) framework for content delivery, and (c) perceptions and insights. The teaching and learning theme refers to methods, experiences, and procedures that are a part of the students' teaching and learning experiences. The framework for content delivery theme relates to issues that arose regarding philosophical approach to and actual delivery of content within the curriculum. Finally, the perceptions and insights theme consists of factors, personal experiences, and feelings identified by subjects during their first year in the GVSU PT program.

Each theme was divided into subthemes. Included in the teaching and learning theme were two subthemes: (a) traditional experiences, including the categories lecture, testing/exams, practical examinations, application of content, and hands-on laboratory experiences and (b) nontraditional experiences, consisting of the categories self-directed learning, groups, and problem-based learning. Subthemes within the framework for

content delivery theme were volume, organization, memorization, integration, and repetition. The perceptions and insights theme contained the following subthemes: stress, learning style, failure, guidance and feedback, and personal reflections. Figure 1 displays the qualitative themes (top boxes, bold type), subthemes (secondary boxes, italic type) and categories (bullet points).

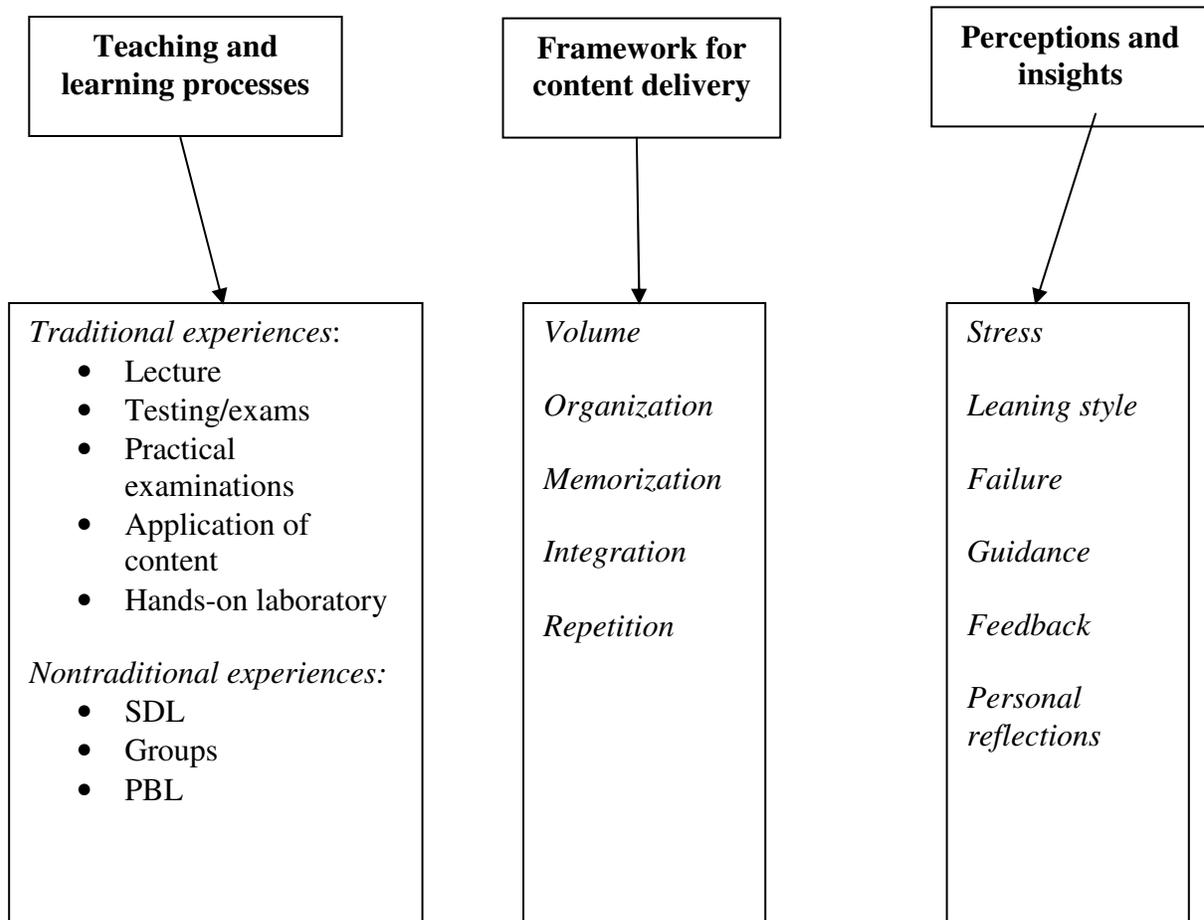


Figure 1. Chart of qualitative data themes, subthemes, and categories.

The themes and subthemes listed above are defined as follows:

Teaching and Learning Theme

The teaching and learning theme refers to instructional and learning methods, experiences, and procedures that are a part of the teaching and learning experience. Two

distinct subthemes emerged, each with separate categories. Note that all quotes are actual, unedited quotes extracted from the oral interview transcripts.

Traditional experiences. This subtheme refers to teaching and learning processes familiar to students from undergraduate or other previous educational activities.

- Lecture refers to traditional, teacher-centered content delivery in which the instructor speaks in front of the classroom and the learners receive information. Most comments were related to comfort with or preference for lecture for delivery of content. Students strongly preferred lecture and laboratory content that were aligned. One individual stated, “I like lecture. I like the information given to me, and I like to take notes on it based on my own understanding to help me grasp concepts.” Several subjects reported that lecture was a good match for their learning styles with comments such as the following: “I think the lecture style matched for me because we have done it for so long it was comfortable.” Negative comments about lecture were less frequent but centered on lack of organization or context for lectures and lectures that lacked visual aids. Two students offered negative comments about lecture: “Instructors that [sic] don’t use PowerPoint or don’t use visual aids that doesn’t [sic] help me learn” and “If you are going to do a lecture, then it should be based on some kind of contextual material. . . so that we can go back and reference if we don’t exactly understand it.”

- Testing/exams refers to the subjects’ perceptions of and perspectives about testing and examination procedures and practices. Students reported frustration with exams in the first year because the level of application and synthesis was more than they were used to. One student stated, “I think that when you take the exams the way the questions are written, it’s not ‘OK, here is the question, here is the answer.’ You actually

have to read it, think through it, and rationalize something. You can't just memorize, or you are not going to pass the exam." Likewise, they reported difficulty knowing whether they had mastered content on the basis of exam performance. A student reported, "It is difficult sometimes, based on the assessment, to know if you got what you needed to know." Another student stated, "I was more worried about passing the exam than learning the information....I just wanted to move on instead of going, 'OK, what do I need to know?'"

- Practical examinations refer to the subjects' perceptions of and perspectives regarding practical examinations. Comments on practical examinations taken during the first year were much more positive than those related to written exams. One student reported, "In a way it was satisfying, that we could perform some of the things we might not have read a question and answered correctly on the test." Generally students were satisfied with practical testing and felt it built their confidence. One stated, "The way we were tested [practical examinations] was a little different. You are given information in lecture, and you learn things in lab and then are tested in a clinically applicable sort of way." Another stated, "I felt the practicals were actually good, like a time to be satisfied with my learning." Students felt some stress, but that was overcome when they became familiar with the format for the practicals.

- Application of content refers to the transferability of content to actual situations. Students reported that positive learning experiences often related to an instructor's ability to offer real-life examples and make content applicable. One student reported, "I think that it helps when teachers give real-life examples so there is context to what we're learning." Many of the student comments were related to the application of content

during clinical experiences. Most comments were positive and related to the realization that their knowledge was applicable to actual patients and clinical situations. During this first clinical experience (4 weeks duration, after the second didactic semester) many students did realize the depth of their learning. One student commented, “[You] impress yourself a little bit with how much you know. I think that sometimes...we tend to get bogged down by those letter grades and things like that, not realizing, giving ourselves enough credit that we do know what we need to know.” On a similar note, another commented, “That [clinical] was a real confidence booster. It helped you be satisfied with what you know now and makes everything you went through the entire first year worth it.”

- Hands-on/laboratory experiences refer to the learning that occurs and perspectives regarding laboratory portions of the learning experience. Many students reported their preferred learning style to be “hands-on,” using words and phrases such as “imitate,” “makes you have to do it,” and “actually doing it.” Regarding hands-on learning, one student stated, “I think it sticks with you longer than just reading it in a book if you actually remember doing it,” and another echoed the thought: “[Hands-on] because you are actually practicing what you would be reading from a book, [which] cements it more in your memory. You can understand what they’re saying better when you are actually doing the motions.” Another large group of comments related to the students’ preferences for demonstration and step-by-step instructions for novel procedures. One student reported, “I think it helps sometimes with the more difficult tests that we do in lab if we have a demonstration first because with just written words or a picture, it is hard to think

in your mind a picture of what you are doing.” Another added, “I kind of like to watch something first and then try it so I can kind of imitate . . . but still learn what I am doing.”

Nontraditional experiences. Nontraditional experiences refer to teaching and learning processes that are a part of the GVSU PT curriculum that are unfamiliar or less familiar to students from their previous learning.

- Self-directed learning refers to learning that is directed by the learner in terms of direction, pace, and content. Comments in this category were almost equally divided between positive and negative perceptions. Negative comments related to the novelty of the SDL process and frustration with this type of learning. In regard to novelty, one student stated, “It was totally different than what I was expecting coming from [my] undergrad career, where things were just handed to you and we had to memorize.” In regard to frustration, comments ranged from “There is only a certain point that you should be expected to ‘go look it up’ or ‘go figure it out yourself’; I felt like I got that all the time” to “[two] classes weren’t directed at all, so you directed yourself, but you didn’t know if you were directing yourself in the wrong way.” Positive comments about the SDL process related to autonomy and growth. One student stated, “It made it seem like we had some control over what we were going to learn and how we wanted to learn it.” Several students reported the value of being self-directed in the following comments: “I think it’s realizing that you can be an independent learner and how important that is;” “to know that you need to actually go out and find information on your own;” and “I think the program did a good job of making us into independent learners, personally.”

- Groups refers to learning that occurs within student groups in contrast to individual, independent learning. Most of the student comments about working in groups

were positive. One student offered the following: “It helped me because I love hearing other people’s perspectives on different [topics]. I can look at it one way, but then another person might see it differently, and that helps me learn better and makes me understand the material a lot more clearly.” One student noted, “In the first year [of] PT school how quickly...as a whole class we developed a group dynamic and everyone found their place in it and [it] helped everyone to get through the first year.”

- Problem-based learning (PBL) refers to learning that occurs when students are given ill-structured problems and must define learning issues and seek direction for learning. By far, this category had the most comments by students. Of a total of 59 comments, 55 (93%) were negative with regard to the PBL process, preparation and/readiness for PBL, the amount of guidance and feedback given, and the stress related to coverage of content and test taking. Words such as “lost,” “frustrating,” “abstract,” “uncomfortable,” and “stuck” characterized the students’ responses. Following are some of the negative responses: “It’s new for us, and I think that the way it was set up there was not enough supervision; there weren’t enough tutors.” “I think it’s kind of drastic; you are guided all the way up to this point . . . then you had to learn to figure it out. Like there was no transition between the two.” “Pretty much the whole time I felt lost.” A student observed, “You are never sure if you’re actually learning the same thing as someone else that’s sitting next to you. I was dissatisfied with that.” Another related similar feelings about examinations in the following comment: “Most of the time we didn’t know if we were studying the right thing to know if we [knew] the information. Some of it I still don’t know because our group never got to it.” One student made the following suggestion: “It would help giving a little more instruction in the beginning and

then kind of gauging by the class and the students [when] to back off and let them start the problem solving and problem-based learning as they feel comfortable with it.”

Another added, “The concept of PBL is a great concept in the appropriate arena. To have an entire class strictly PBL was asking an awful lot of the first-year students in this curriculum.” Four positive comments (3%) about PBL were offered by students. One student stated, “I thought that the PBL, the actual searching for information, was good because it opened our eyes to a whole bunch of different conditions that could happen and were possibilities.”

Framework for Content Delivery Theme

The framework for content delivery theme refers to issues that arose regarding the philosophical approach to and actual delivery of content within the GVSU PT curriculum.

Volume. The volume subtheme refers to issues related to content delivery over time: how fast or slow content is delivered. All comments in this subtheme related to the high volume and stringent demands of the GVSU PT program. One student reported, “I don’t know if I was ready for the amount of work that we were going to have to do. I knew it was going to be hard, by, like, especially the first semester, I was just, like, what in the world is happening? Like a freight train.” Another individual questioned, “What good is it [learning] if you can’t even grasp enough to further yourself?” Another made a comment, “What hindered people from being good at thinking instead of memorizing is the amount of information and the lack of instruction that went along with it. I could memorize the information but I had no time to apply it.” One student reported a positive connection between volume and self-directed learning behaviors. “They teach you a lot of stuff in a little bit of time. I think it is a good thing because I didn’t think it was possible

to learn as much as I had. I think all of us are now more self-directed learners and want to learn more. I think the program really facilitated that.”

Organization. The organization subtheme refers to the organization of content during delivery in a single lecture, course, or semester or within the entire curriculum. Overall, students placed a high value on organization. Most of the comments in this subtheme related to lack of organization or structure within educational experiences. Although students previously reported their preference for lecture, many reported frustration with a poorly organized lecture. One stated, “I would leave lecture not even knowing what the lecture was about; we would jump into the middle of something, and I’m starting to write, and I have no idea” Another added, “It’s hard to know what you need to know when it’s so unorganized,” and “It’s hard to apply what we’ve talked about in class to what we’re expected to know.”

Memorization. The memorization subtheme refers to a student’s ability to internalize and memorize factual pieces of information, in contrast to synthesis or conceptual organization. Students generally reported frustration with trying to memorize facts. One student stated, “It is hard to memorize a bunch of structures when you don’t know what is going on.” The memorization method of learning was preferred by some graduate students, as evidenced by the following statements: “This was easiest for my learning style, ‘you need to know exactly this, go home and memorize this, this is all you need to know--’; it is easier to study off that because it wasn’t so abstract,” and “When I think of the easiest, that’s the easiest [memorization].” Thoughts about memorization seemed to align with thoughts about lecture. Students seemed to prefer lecture and

traditional methods of learning, including memorization, which contrasts with the demands of active, nontraditional learning common to the GVSU PT program.

Integration. The integration subtheme refers to the cohesiveness of content delivery within a course or semester. Lack of integration was frustrating to students who claimed that it hindered their learning. One comment illustrates this feeling: “You tried to create some integration between classes, and it failed miserably. In a sense, one professor is telling you one thing and another professor is telling you, ‘That’s not how you do it’ or ‘That’s not the preferred way.’ So, you’re just kind of lost in the middle.” Students seemed to want consistency between instructors. One student offered the following suggestion: “Get on the same page, but also work together so that it helps us understand . . . thinking of the bigger picture.”

Repetition. The repetition subtheme refers to the utility of repeated information. Subjects viewed repetition as positive (assisting them in retaining content), or as negative (a “waste of time”). Repetition comments were split equally between positive and negative comments. “[Repetition] was valuable when it wasn’t busy work and was relevant. When we were given the chance to repeat things and ask questions and discuss the relevance of something and when you would use it;” “We definitely had a whole hour-and-a-half lecture and thinking ‘you guys taught this already; what are you doing?’”

Perceptions and Insights Theme

The perceptions and insights theme refers to factors, personal experiences, and feelings identified by subjects during the first year of the GVSU PT curriculum.

Stress. The stress subtheme refers to experiences in the first year that left students feeling anxious or uncomfortable. Students reported a significant amount of stress during

their first year. One student stated that she felt she was in “survival mode.” Another noted, “I know that a lot of people had a lot of that-- stress. I think it is what makes the first year so hard.” She offered the following suggestion: “It could be reduced in a lot of ways, and help people enjoy it more instead of being so worried. Let them [the students] know what is going to happen.” Another comment was “I think [that] the focus in the program needs to be how can you get kids more acclimated to the program, get them more comfortable.” Comments also focused on feelings about stress that were positive: “I got through my first year, and that’s big, you know? It’s a milestone in my life. I mean it feels good to know that you can have that much stress on you, that much information that you needed to know, that much expected of you and be able to get through it.” Another noted, “I feel in a way, though, that’s the point. Like we’re supposed to be struggling and kind of feeling a little squirmy, like what is the new situation? That’s kind of what real life’s gonna be like when we get done. Not someone holding your hands the whole way through It’s frustrating, but I think it’s good too.”

Failure. The failure subtheme refers to students’ feelings of inadequacy or lack of success during the first year. Many of the students’ feelings of failure related to performance on examinations. One student reported, “If you’re not able to do well and you get number grades that are bad, it’s kind of disappointing and depressing, like, ‘I’m not good enough’” and described the experience as “disheartening.” Others used the phrases “totally defeating,” or “not good enough,” or words such as “terror” or “tough” to describe their experiences. Often these feelings had to do with comparisons to performance in undergraduate studies as reflected in the following comment, “Especially coming from [undergraduate education], I was used to being somewhere at the top of the

class and being smart and not having to work.” Students said, “It’s the most awful feeling being, like, I’m the top of my class to being, like, middle, maybe bottom,” and “One minute you go from looking at the top down to the bottom up.”

Guidance/feedback. The guidance/feedback subtheme refers to students’ perspective related to instructor assistance and response to attempts at performance in psychomotor and cognitive skill sets. Without exception, feedback and guidance were viewed as positive factors for learning. One student voiced his opinion: “If you have a professor check something I was doing, is this right or is this really what I am feeling? [It helped] when they make the small adjustments as they go.” Another stated, “In lab when you would be doing something and someone would come and critique your technique and then later see you doing it good [sic] and tell you that you’re doing better.” The converse was also true; “Feedback is very important to know whether you know it or not. It’s hard to know if you’re doing it well enough.” Universally, students were dissatisfied when guidance and feedback were lacking. “We didn’t have a chance to actually learn how to write with proper feedback,” and “We all struggled with knowing if we knew what we needed to know or not.”

Learning style. The learning style subtheme refers to students’ self-understanding of how they learn in various situations. The most frequently reported learning style preference was “visual” for both classroom and laboratory learning experiences, followed by “hands-on.” A student reported, “I would say that visual learning helped to connect when I am doing it myself, to if I was given a verbal instruction on something and then have to go do it in a hands-on sort of activity.” In addition a preference for visual learning, students expressed an inclination toward more active learning experiences. One

stated, “Discussions and class taught me to engage a lot more and to think about more than just staring at a screen.” Textbook reading was not preferred by many of the subjects, as shown by the following comment: “When you are sitting learning from a book or something it is hard to know what you don’t know.” This subtheme relates to the previous category of hands-on learning, a methodology preferred by many students. It is logical that those who prefer more kinesthetic, hands-on methods for learning would like visual (reading) learning less.

Personal reflections. The personal reflections subtheme refers to general comments about the first year of the GVSU PT curriculum that relate to a summary of the experience. This subtheme contained a wide variety of thoughts and perceptions regarding the first year. Balance between academics and the rest of life was elusive. One student stated, “I remember at orientation they talked about balance. I mean it’s so hard, you have to keep perspective...the first semester you’re thrown into something that’s so huge of a magnitude with tons of information like you’ve never experienced before.” Several reported that “taking time for myself was hard,” and that the “whole balance thing doesn’t happen.” Students valued the social support they found within their class. One stated, “You know, I think it’s because of the relationships that we had, whether they be other than just friends, that makes it easier for us to get through school because we have that support system there.” Another added, “We understand each other...it helps to have someone you can actually identify with. That you’re going through the same thing at the same time and you can vent to each other [sic].” Learning throughout the first year was different than what students had previously experienced. One student said, “The study skills they teach you in high school and in college, and they tell you to use, weren’t

really necessary for me in undergrad, but I found myself using them in grad school.”

Another summarized his feelings: “You really have to think in order to understand what is being asked of you,” and “you have a different attitude, like I need to be able to get these grades in order to be able to keep going on. I want to do this and I want to go on. It’s so much more practical than anything else I have ever done. I’m in graduate school; I have to focus.” The students seemed to realize that they were only at the end of year one of a three-year curriculum. One stated, “After the first year I don’t feel like we are supposed to feel satisfied because we have so much more to do. It’s like nothing is ‘done’; we don’t know the end of anything.” Some students were philosophical about their learning: “I feel like I’ve changed a lot, don’t know specifics really, but I just feel different. I feel more comfortable with myself and where I’m going. This first year set in my mind that I really want to do this.” “Some things, you know, it is just good to let it go and learn from what you did right, what you did wrong.”

Summary

The scores for the pre- and posttest administrations of the WGCTA were determined to be statistically different but practically not significant, as a difference of one point does not match the critical threshold for change of four points as described by Wilson (2000). The mean scores for the pre- and posttest administrations of the SDLRS-A approached a statistically significant difference, but the students actually performed more poorly on the posttest administration, indicating less readiness for self-directed learning. Cluster analysis demonstrated that students gave better ratings to some classes (PT 418, PT 420, and PT 421), whereas they rated others (PT 481, PT 408, PT 422, PT 425, and PT 482) as poorer. These clusters of better rated and poorer rated classes did

not correspond to the educational methodology used for delivery of content, as both clusters contained classes with both traditional and nontraditional delivery. However, the course that was rated lowest in end-of-course and questionnaire analyses, PT 482 (PBL instructional method), was in the *poorer* cluster for both the end-of-course evaluation and the additional questionnaire questions, indicating less satisfaction. The course rated the highest by analyses of end-of-course and questionnaire items, PT 421 (lecture, case-based laboratory methods), did appear in the *better* cluster for both the end-of-course evaluation and the additional questionnaire questions, indicating greater satisfaction.

Several research questions were addressed. The methods described by students as most comfortable were lecture and laboratory (both considered traditional methods), demonstrated by quantitative analysis of questionnaire items and supportive qualitative data. Students were overwhelmingly least comfortable with PBL and SDL types of learning situations. This discomfort does fit with the students' poorer performance on the SDLRS-A at the conclusion of the first year.

Qualitative data demonstrated a high degree of dissatisfaction with the PBL process, and quantitative analysis of questionnaire items also demonstrated that lowest satisfaction was with PT 482, the only totally PBL course offered in the first year of the GVSU PT curriculum.

The following research questions are restated and their answers are presented:

1. What is the difference in students' critical thinking skills between when they enter the GVSU-PT program and when they complete their first year of instruction?

Students demonstrated a 1.07-point-difference improvement in their WGCTA scores between the beginning and the end of the first year of the GVSU PT program. This difference was statistically significantly different ($p = .05$).

2. What is the difference in student perceptions of self-directed learning readiness between when they enter the GVSU-PT program and when they complete their first year of instruction?

Students demonstrated a mean decline of 4.63 points on the SDLRS-A between the beginning and the end of the first year of the GVSU PT program. This difference approached statistical significance ($p = .06$).

3. What is the difference in end-of-course-evaluation scores related to teaching methods (i.e., responses to items #16, #18, #20, #21, #23, #34 on the end-of-course evaluations) between courses described as lecture, case-based, or discussion and those described as PBL?

End-of-course-evaluation scores on the previously mentioned questions were most positive for PT 421 (a lecture and case-based course) and least positive for PT 482 (a PBL course). There was no consistent pattern of satisfaction between courses solely based upon teaching methodology.

4. Which modes/methods of instruction do students indicate as most effective or comfortable?

Students described lecture and well-coordinated lecture and hands-on laboratory as the most effective and comfortable for their learning. They also expressed a preference for memorization.

5. Which modes/methods of instruction do students indicate as least effective or comfortable?

Students described PBL instruction as the least effective and least comfortable for learning.

6. What learning experiences do first-year PT students describe as matching their learning styles?

Students described lecture, memorization, and hands-on laboratories as matching their learning style.

7. What perceptions about learning in their first year of the GVSU-PT program do the students describe?

In general, students described a high-volume course load that, when combined with new or altered educational demands, caused them anxiety and stress. They also questioned whether they learned what they needed to learn within the first year of instruction and expressed their doubts related to how learning affected their perceptions of and success or failure on examinations. Practical examinations were generally perceived as positive learning experiences. Applied content was highly valued, as were the clinical placements that occurred during the first year.

8. What are the students' perceptions of, and comfort with, the types of teaching/learning used in the GVSU mixed-curriculum design?

In general, students stated a preference for organized, clear content, presented in lecture and more traditional formats, and discomfort with PBL or highly SDL environments. Perceptions of PBL were largely negative. SDL experiences were described as challenging and difficult but were valued for the way in which they

developed the learners. The majority of students viewed learning in groups positively. They valued guidance and feedback given by instructors in all settings (classroom, seminar, labs) and noted dissatisfaction and frustration when guidance and feedback were lacking.

Perceptions of the curriculum included student thoughts related to the teaching and learning processes, the framework for content delivery and student perceptions, and insights related to their experience in the first year. Implications derived from the qualitative analysis of themes and subthemes are presented in chapter 5, along with discussion and conclusions about both the quantitative and qualitative data and suggestions for further research.

CHAPTER 5: DISCUSSION AND IMPLICATIONS FOR FURTHER STUDY

The purpose of the present study was to assess and describe the performance and perceptions of first-year physical therapy students enrolled in the Grand Valley State University Physical Therapy Program (GVSU PT). During the first year of the mixed-design curriculum, the students are required to learn not only factual knowledge but also to increase their performance in important skill areas, such as the abilities to be critical thinkers and to be self-directed in their learning. The research questions investigated were the following:

1. What is the difference in students' critical thinking skills between when they enter the GVSU-PT program and when they complete their first year of instruction?
2. What is the difference in students' perceptions of self-directed learning readiness between when they enter the GVSU-PT program and when they complete their first year of instruction?
3. What is the difference in end-of-course-evaluation scores related to teaching methods (i.e., responses to items #16, #18, #20, #21, #23, and #34 on the end-of-course evaluations) between courses described as lecture, case-based, or discussion and those described as problem-based learning (PBL)? (Refer to Appendix A for designations of courses in the first-year PT curriculum.)
4. Which modes/methods of instruction do students indicate as most effective or most comfortable?
5. Which modes/methods of instruction do students indicate as least effective or least comfortable?

6. What learning experiences do first-year PT students describe as matching their learning styles?
7. In their first year of the GVSU-PT program, what perceptions about learning do the students describe?
8. What are the students' perceptions of, and comfort with, the types of teaching/learning used in the GVSU mixed curricular design?

The present chapter contains the researcher's discussion of the findings described in chapter 4, explanations of these findings, and applications of the findings to practice/education. Finally, limitations of the present research are summarized with implications for future research projects.

Discussion of Findings

Two tests were administered to the first-year GVSU PT students in a pre- and posttest design to obtain quantitative data about students' Critical Thinking (CT) abilities and Self-Directed Learning (SDL) readiness. The students studied in the current research showed little improvement in their critical thinking abilities and no improvement in their self-directed learning readiness as measured by the WGCTA and SDLRS-A, respectively.

WGCTA Discussion to Answer Research Question #1

The subjects' pretest mean WGCTA score was 30.44, and their posttest mean score was 31.59. These means were statistically significantly different. However, although the GVSU PT students had statistically different mean scores between their pre- and posttest administrations of the WGCTA, the 1.07-point mean difference is not practically significant. According to Wilson (2000), with the use of statistics supplied by

the test manual (test-retest reliability = .73, standard deviation = 8) ($P > .95$) a critical change value for the WGCTA of four points can be calculated.

The lack of practical change in critical thinking scores in the GVSU PT students is similar to the findings of several previous studies of health professions students that used the WGCTA (Richards, 1977; Berger, 1984; Sullivan, 1987; Slaughter et al., 1989; Pepa, Brown, & Alverson, 1997; Adams, Stover, & Whitlow, 1999; Wilson, 2000). Of these studies, only one used the WGCTA to examine critical thinking in PT students (Slaughter et al., 1989).

The lack of growth in CT skills (as measured by WGCTA scores) in the GVSU PT students is similar to the findings of Slaughter et al. (1989), who studied PT students by comparing their preadmission WGCTA scores with their scores after a four-week clerkship (clinical placement). The WGCTA scores of the Slaughter et al. students actually decreased by an average of 2.61 points over the four-week clerkship. Slaughter et al. (1989) used the full-length WGCTA, as compared to the short form used in this research, so an exact score comparison cannot be performed.

In a study of PT students, Wilson (2000) used the WGCTA to establish concurrent validity for the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI). Wilson reported acceptable concurrent validity for the CCTST and the WGCTA (.78) and poor concurrent validity for the CCTDI and the WGCTA (.39). An outcome of Wilson's study was that the PT students failed to demonstrate meaningful improvement in the first two semesters of graduate professional PT education on either the CCTST or the CCTDI.

In another study of the development of CT in PTs, Vendrely (2005) studied students over an entire PT curriculum of seven semesters that spanned 27 months. She found no change in CT in her students as measured by the CCTST. Because the CCTST was shown to have acceptable concurrent validity with the WGCTA by Wilson (2000), the findings of Vendrely are not unlike the findings of the current study. Vendrely offered several possible reasons for the lack of CT change: a ceiling effect, altered conditions between pre- and posttest administration, and a small sample size. The same explanations for a lack of change in CT scores could apply to the current study.

In contrast to Wilson (2000), Vendrely (2005), and the current study, Bartlett and Cox (2002) found statistically significant improvements in both the CCTST and the CCTCI test scores during a curricular year. They also concluded that more change was detected by the CCTDI than by the CCTST, and that the CCTCI took less time to complete.

Several possible reasons for the lack of practical change in GVSU PT scores on the WGCTA should be discussed. Slaughter et al. (1989), and Vendrely (2005) described a ceiling effect on the scores on tests used in their research, as their students posted high scores on their initial test and had little room for improvement. Students in the current research did not exhibit such an effect. The GVSU PT students' initial mean score of 30.44 of a possible 40 points does not suggest a ceiling effect.

It is unlikely that a difference in physical conditions between pre- and posttest administration contributed to the performance of GVSU students on the WGCTA. Each test administration was performed in a structured classroom environment, with standard instructions, and did not allow for discussion between students. What cannot be

accounted for is the difference in mood of the students during the pre- and posttest times, which may have affected their performance on both of the standardized tests.

Like in the Vendrely (2005) study, a small sample may have contributed to the lack of change, as there were only 41 students in the current study. Certainly, this small sample is a limitation that prohibits the ability to generalize results, but it does not seem a likely explanation for lack of change.

Another possible explanation for the lack of improvement is the potential measurement error inherent in the WGCTA when used with healthcare professionals (Wilson, 2000; Slaughter et al., 1989). The WGCTA is a test of the general construct of CT rather than of CT in the discipline of PT. In the current research, this is the most likely explanation for the lack of change. Students may have performed better if they had been given discipline-specific CT scenarios and questions to measure their progression of development of CT related to the practice of PT. Research on the promotion or development of CT in PT and OT students has been difficult because a reliable, valid, utilitarian instrument to measure CT does not exist (Vroman & MacRae, 1999). The nursing literature also suggests that CT assessments often define CT too narrowly and therefore do not adequately address the myriad of factors that are included in the critical-thinking process (Rane-Szostak & Robertson, 1996). In order to fully understand the impact of a curriculum or instructional methodology on the development of CT in PT students, theory regarding CT specific to PT must be developed (Vendrely, 2005). Such theory could assist in developing a meaningful measurement tool for this population. This suggestion is addressed in more detail in a subsequent section on suggestions for future research.

Finally, it is possible that the GVSU PT students simply did not change their CT abilities and skills in the first year. It is likely that their CT abilities will continue to develop over the remaining two years of the curriculum. Administration of the WGCTA at the conclusion of the curriculum is possible, as this cohort has remained intact and could be asked to complete the test one final time. Perhaps the entire mixed-design curriculum will have a different effect on CT than the first curricular year alone had.

The only other study the researcher found that addressed the use of the WGCTA in PT students was performed by Gross (1989), who correlated WGCTA scores and GPAs in PT students. He found a weak positive ($r = 0.29$) statistically significant correlation ($P = 0.037$) between WGCTA scores and GPA at admission. GPA data upon admission to the GVSU PT program were not used for correlation, as grades and academic achievement were not the focus of the current study.

SDLRS-A Discussion to Answer Research Question #2

The subjects in the current study showed a decline in performance on the SDLRS-A that approached statistical significance over the first year of the curriculum. This decline in performance needs to be carefully examined.

One report of the SDLRS-A as an assessment of PT students appeared in the literature. Linares (1999) studied SDL in allied health programs including nursing, occupational therapy (OT), physical therapy (PT) and physicians assistant studies (PAS) and reported the SDLRS-A scores for them ($n = 596$), of which PT was one small group ($n = 31$). Although nursing and PAS health professions students were described as “highly self directed,” PT and OT students scored mostly in the low-to-average range and thus were described as “average” in their self-directedness. Linares (1999) reported on a

single test administration, and therefore, differences between pre-and posttest data cannot be compared between that research and the current study.

Linares (1999) did not report individual or mean scores on the SDLRS-A for the sample of 31 PT students but provided only the range of scores for the sample, and organized them into descriptive groups as originally described by Guglielmino (1978): *low*, *average*, and *high*. The score ranges for each of the categories are low (141-216 points), average (217-234), and high (235-290). According to Guglielmino (1978), these descriptive groups provide classification as to the readiness and affinity for self-directed learning. Subsequently, Guglielmino (2000) has expanded the definitions to include the categories of low, below average, average, above average, and high (refer to Table 3 for details). These expanded categories are included in the test administration and interpretation booklet.

Of Linares's PT students ($n = 31$), seven (22.6%) were in the low score range, 12 (38.7%) were in the average score range, and 12 (38.7%) were in the high score range. PT students in the current study were grouped into the same descriptive categories in order to compare them to the Linares subject group. On the pretest SDLRS-A, 12 (27.9%) of the GVSU PT students were in the low score range, 16 (37.2%) were in the average score range, and 15 (34.9%) were in the high score range. A greater percentage of students in the current study were in the low group, a similar percentage were in the average group, and a lower percentage were in the high group, indicating a general tendency for participants in the current study to score lower on the SDLRS-A than those in the Linares study. An explanation for this phenomenon may relate to student preferences for learning. Perhaps the group of GVSU PT students in the current study

generally preferred more structured, less self-directed educational learning methods and environments.

According to Guglielmino (1978), persons with below-average SDLRS scores tend to prefer structured learning methods, such as lecture and traditional classroom settings, whereas those with average SDLRS scores are more likely to be successful in more independent situations but may not be fully comfortable with determining their own learning needs and planning their own learning. Persons with high SDLRS scores tend to prefer directing, planning, and implementing strategies for their own learning but may choose traditional, structured learning situations (Guglielmino, 2000). The SDLRS-A scores of the students in the current study ranged from low to high self-directedness. Two thirds (65.1%) of the subjects in the current study scored in the low and average categories, indicating low-to-average readiness for SDL, whereas the remaining third (34.9%) scored in the high category, indicating high SDL readiness.

The subjects in the current study had a mean score on the pretest SDLRS-A of 224.02, and the mean score fell to 219.68 on the posttest SDLRS-A, indicating less affinity for self-directed learning over the course of the first year. A similar decline in performance on the SDLRS-A was described by Walker (2001) in a study of pharmacy students ($n = 68$) over a 16-week PBL pharmacy curriculum. The SDLRS was administered initially before the PBL curriculum, once midway throughout the instruction, and once again at the end of the 16 weeks. The students in the Walker study declined in performance at the first posttest administration by 9 points and in the second posttest administration by 2 additional points (total decline of 11 points). The mean score reported by Walker (2001) for subjects with a mean age of 23.5 years old was 223.55 for

the pretest, 214.42 for the first posttest, and 212.54 for the second posttest. The initial mean score (223.55) in the Walker study is very similar to the initial mean score of the PT students in the current study (224.02), whose mean age was 22.8 years old. The final mean score for Walker's students was 212.54, and the final mean score for the students in the current study was 219.68. Walker concluded that the young adult learner, as she described her students (ages 18-25), had difficulty maintaining his/her perceived ability to learn in a self-directed manner.

The same conclusion could be drawn from the results of the current research: that students had difficulty maintaining their self-directedness in relation to the learning tasks of the GVSU mixed-design PT curriculum. Several possible reasons for the decline in the scores on the SDLRS-A by the GVSU PT students may be posited. The students completed the SDLRS-A at the end of their third semester and may have been disenchanted with SDL methods. They may have reacted to the situations in which they were required to learn throughout the first year and answered accordingly, demonstrating a negative response to the methods of teaching and learning that they had experienced. The students' mood or level of interest in the test at the end of the summer semester may also have contributed to the decline, as they may have been eager to complete the two quantitative tests and proceed to vacation.

The decline in SDLRS-A scores approached statistical significance. No critical change numbers are reported for the SDLRS-A, and therefore, it is unknown whether the decline in performance is practically significant.

Results on Quantitative Tests Based on Age and Gender

The performance of the subjects in the current research on each of the quantitative tests did not appear to be related to or influenced by gender or age. Gender should not affect the abilities of CT or SDL, so this result is not surprising. No significant differences were demonstrated on the WGCTA or the SDLRS-A between genders.

Age, however, may influence an individual's ability to think critically or learn independently. One might hypothesize that more mature adults possess better abilities for CT or SDL. One previous study suggested that older students did better on the WGCTA (Linares, 1999). No information about performance on the SDLRS-A based on age was found in previous research. The students in the current research were fairly homogenous in age with a mean age of 22.78 years (range: 20-34 years old). Statistical analysis did not support the idea that students' scores on either the WGCTA or SDLRS-A were related to age.

Correlation Between the Results on the Two Quantitative Tests

Correlations between outcomes on tests of critical-thinking ability and those of self-directed learning readiness have not been reported in the literature. Critical thinking and self-directed learning may not seem to be closely related concepts. However, the researcher investigated to determine whether any correlation exists between performance on the WGCTA and SDLRS-A. The mean pretest scores on the two quantitative tests were not statistically correlated. Likewise, the posttest scores on the same two tests were not statistically correlated. As expected, this finding may demonstrate both the diverse skills and thought processes represented by the two separate skills or differences in the assessment tools.

End-of-Course Evaluation Discussion--Research Question #3

End-of-course evaluations were examined for each of the PT courses in the first year. Visual analysis of mean satisfaction scores for all the questions used for analysis (#16, #18, #20, #21, #23, and #34) was conducted. Greatest satisfaction with PT 418 and PT 421 and least satisfaction with PT 482 and PT 481 were inferred from the visual analyses.

Teaching methods and instructors are different for the courses PT 418 and 421 and PT 482 and 481. PT 418 and PT 421 were described by students as lecture or lecture/discussion and hands-on lab, whereas PT 482 was described as PBL. The instructional methods of PT 481 were not described by the students; however, this course is defined in Appendix A as nontraditional. Reasons for higher satisfaction with PT 418 and PT 421 may relate to the type of instruction encountered in these courses, and this quantitatively described satisfaction is relevant in light of qualitative data that expressed students' preferences for hands-on labs, lecture, and structured, organized content delivery. Likewise, dissatisfaction with PT 482 may be explained by the course's being the first totally PBL course the students encountered in the curriculum. This assumption is also supported by the qualitative data that offered a negative assessment of PBL as an instructional method. The students reported a high degree of discomfort and dissatisfaction with the PBL methodology. This is discussed in subsequent sections.

PT 418 and PT 421 were taught by the same instructor, and PT 482 and PT 481 were each taught by different instructors. Hence, higher or lower satisfaction reported via end-of-course evaluations may be due to students' preferences related to teaching

style of the instructor, personality of the instructor, or assessment techniques used in the course.

Cluster analysis was used to statistically analyze end-of-course-evaluation results. This analysis supported the idea that two distinct clusters existed. Cluster 1 (those courses receiving more positive evaluations) comprised PT 418, PT 420, PT 421, and HS 461, and Cluster 2 (those courses receiving more negative evaluations) comprised PT 481, PT 408, PT 422, PT 425, PT 482, and HS 427. Few conclusions can be drawn from the courses that were clustered together in relation to teaching methods, as both clusters include courses that use both traditional and nontraditional methods. The negative cluster does contain both PT 482 and PT 481, and the positive cluster does contain PT 418 and PT 421, supporting the results of the visual analysis of scores described above.

Additional Questionnaire Discussion--Research Questions #4 and #5

Additional questions, provided in the form of a questionnaire, were also used to garner information about perceptions by students of some PT courses in the first year of the curriculum. These additional questionnaires were not distributed to the Health Science classes, as there were students of other programs (Physicians assistant studies, Occupational Therapy, general Health Science majors) in those classes.

The questionnaire developed by the researcher of the current study was piloted in one PT course in the first semester and then distributed to all second-semester PT classes. Visual inspection of descriptive numerical data demonstrates that students were most comfortable with PT 421, a lecture and case-based lab course and that students were least comfortable with PT 482, the only completely PBL course in the first year.

Cluster analysis was also used to analyze questionnaire responses. Cluster 1 (those courses receiving more positive responses) comprised PT 418, PT 420, and PT 421. Cluster 2 (those courses receiving more negative responses) comprised PT 422, PT 425, and PT 482. Cluster analysis identified question six as the only question where a high value was good. Question six has opposite sign values in the cluster center vectors than do the other questions, and it did contribute to placement of a course into the positive or negative cluster.

The courses examined in both discriminant analyses demonstrated the same cluster membership for each of the positive and negative clusters. Both positive clusters (using end-of-course evaluations and additional questionnaire) contain the same courses: PT 418, PT 420, and PT 421. Likewise, both negative clusters contain PT 422, PT 425, and PT 482. This outcome demonstrates consistently greater or less satisfaction with these six courses but cannot demonstrate that membership in a cluster is simply related to a teaching method, as each cluster has courses delivered by both traditional and non-traditional methods. Therefore, it is likely that topics not assessed in the present study, such as instructor, content, and assessment methods, may have each played a role in student satisfaction based on the questionnaire.

In the end-of-course-evaluation and questionnaire data, PT 482, the only completely PBL course in the first year, was assessed the most negatively. Two courses taught by the PT 482 instructor were placed in different clusters, one positive and one negative. PT 420 (using case-based, hands-on lab teaching methods) fell into the positive clusters in both analyses, and PT 482 (using PBL teaching methodology) fell into the negative clusters in both analyses. This suggests that in this case, the instructor may not

have been the reason students were satisfied or dissatisfied with a course; rather, the teaching methodology influenced their satisfaction. The placement of PT 420 in the positive clusters and of PT 482 in the negative clusters is consistent with qualitative results regarding the preference for structure and hands-on labs and greater dislike of PBL as a method of instruction.

PT 425 (a traditional, lecture-based course with SDL objectives) fell into the negative cluster in both analyses. This course appears to be highly structured, with lecture delivery of content. The lectures are often provided by outside lecturers (physicians and other health professionals) and are often less organized or true to the objectives given for the content. Therefore, students are responsible for being self-directed and achieving all objectives regardless of the content of lectures in the course. This may explain the location of PT 425 in the negative cluster.

Qualitative Data Discussion--Research Questions #6, #7, and #8

Qualitative data support that students in the current sample prefer “traditional” types of instruction, such as lecture and structured labs. The students also described themselves with a preference for “hands-on” learning experiences, most often in context of laboratory instruction.

Linares (1999) reported that many adult students stated that their previous educational experiences were in rigid, structured environments. Experience certainly may affect students’ perceptions of SDL. The students in the GVSU PT program may have had previous educational experiences similar to those described by Linares. The results of the current study are probably most easily explained both by the GVSU students’ previous experiences and by their educational history with such methods. Most

students are admitted to a graduate professional education program after having been educated as undergraduates by traditional methods, such as lecture and structured laboratory. Few have in-depth experience with nontraditional methods, such as discussion, seminar, and self-directed and group learning. Undergraduate students seldom experience the PBL method. Therefore, their stated preference for more traditional teaching and learning experiences is not surprising, as is evidenced in the following quote: *“It was totally different than what I was expecting, coming from an undergrad career where things were just handed to you.”*[italics added]

Students in the current study were clear in their descriptions of themselves as hands-on learners who were successful when lecture and lab instruction were well coordinated and aligned. The preference for hands-on learning experiences is understandable because of the nature of the professional training of a PT, which is very psychomotor in orientation. PTs must be adept at many techniques that are best learned by practice and psychomotor instruction.

Previous studies (Tavakol & Reicherter, 2003; Albanese & Mitchell, 1993; Solomon et al., 1996) disagree on the perceptions of students in PBL courses or curricula. In contrast to the current data, Tavakol and Reicherter reported that most students, with or without prior PBL experience, described PBL as “challenging, exciting and enjoyable.” In fact, students in the current study had only a few positive comments about PBL.

Subjects in the current study were clear about their dislike of PBL. Perceived disadvantages of PBL included anxiety (Tavakol & Reicherter, 2003), stress, increased out-of-class time commitments, interpersonal conflicts (Solomon, et al., 1996), and the

amount of time needed for searching for information (Williams et al., 1995). Such negatives were found in the qualitative data of the current study, including reports of stress and anxiety and difficulties in scheduling out-of-class group meetings.

Derechtn and Contant (1999) reported that medical students enrolled in a mixed-design curriculum indicated a desire for more traditional lecture and rated SDL lower than those enrolled in the traditional curriculum. Although not directly comparing students between two types of curricula, the results of the current study suggest that students prefer lecture and structured learning experiences.

Garity (1985), Linares (1989), Rezler and French (1975), and Rezler and Rezmovic (1981) reported that students in health occupation and nursing programs prefer concrete and teacher-oriented learning conditions. In contrast, Olson and Scanlon (2002) found that 34.2 % of their PT students possessed dual learning styles (Concrete sequential [CS] + Abstract Sequential [AS] or CS + Abstract Random [AR] or AR +Concrete Random [CR]), which may best serve PTs. The top-rated, single Gregorc Style was concrete-sequential (CS). Concrete refers to tendency to rely on physical senses, and sequential, linear, methodical, and logical thinking. CS was also a component of both of the dual learning styles. CS was correlated positively with structured teaching and traditional learning. PT students in the Olson and Scanlon study (2002) appeared to prefer active learning (concur with lab and hands-on), wanted guidance in individual study (SDL), and preferred programmed (organized) classroom instruction. The students' preferences in the Olson and Scanlon study are very similar to the stated preferences of GVSU students. Olson and Scanlon's students showed an aversion to SDL, and the authors commented that if SDL is a necessary attribute for professionals,

then the relative aversion of these students toward SDL may be problematic. Likewise, the qualitative and quantitative findings of the current study indicate that the GVSU PT students were less enthusiastic about SDL at the completion of the first curricular year even though SDL is considered important to the profession of PT.

Rezler and French studied PT students as subgroup of students in six allied health professions programs. The PTs' preferred learning styles were more concrete (tangible, specific, practical tasks, with a focus on skills) and teacher centered (well-organized, teacher-directed class, expectations and goals clearly articulated); this is in agreement with the findings of the current study, in which students craved organization, liked lecture, and desired hands-on, skill-focused labs.

Findings of the current study were similar to those of Lunyk-Child et al. (2001), who qualitatively studied the perceptions of nursing students related to the process of SDL. Several themes identified in the current study were similar to those in the Lunyk-Child study. These included one that indicated students were searching for confirmation, one that related to consistency, and one regarding whether all students perform SDL similarly. The lack of confirmation about whether correct content learning occurred poses a possible source of frustration among students in the process of SDL. Students wonder whether the whole class is getting what they need to know and whether they are fulfilling educational objectives. Students in the current study and in the Lunyk-Child study expressed concern about the SDL component of the learning process. Students may begin with dependent behaviors when they enter into a new learning experience and later develop interdependent behaviors. The findings of the current study clearly describe the students' need for structure and direction in the beginning years of a mixed-design

curriculum. Above all, students valued organization and direction in courses, both in lecture and discussion as well as in laboratory settings. Visual analysis of data related to course satisfaction illustrated this, showing that the students were most satisfied with courses that had lecture and lab components.

It is interesting that the lecture method of learning and memorization was still preferred by several graduate students. The following statements illustrate this preference: *“This [lecture] was easiest for my learning style”*; *“you need to know exactly this, go home and memorize this, this is all you need to know”*; *“it is easier to study because it wasn’t so abstract”*; and *“when I think of the easiest, that’s the easiest”* [italics added]. In an era where simple memorization is not enough to sustain the evolving evidence-based practice of PT, students may need to alter their preferences and realize that other methods of learning may be of greater benefit to them.

Conclusions and Suggestions for Practice (GVSU)

Physical therapy educators have been challenged to concentrate on the process of learning rather than to lay emphasis solely on the content to be mastered (Solomon et al., 1996; Shepherd and Jensen, 1990). In attempts to do so, instructors have adopted many strategies for instruction that include techniques for developing CT and SDL.

If students prefer lecture and case-based learning and hands-on learning and do not prefer PBL, then the GVSU faculty should consider other ways of active learning besides PBL. Many strategies and teaching methods exist that are active in their processes but are not considered PBL. Examples of alternate strategies include case-based learning, Socratic discussion and questioning, reflective journaling, and concept mapping. Encouraging all learners to take full advantage of resources in the forms of

printed materials, audio-visual media, and personal contacts provides an excellent way to promote active, self-directed learning. Such alternate strategies should be explored by the GVSU PT faculty who provide the first-year instruction. It is impossible to determine from this research if any instructional method, including PBL, is acceptable or unacceptable, as this was not its intent.

If students overwhelmingly do not prefer PBL and are low-to-average in their SDL scores, then a more gradual progression from traditional methods into non-traditional methods should be considered. Although important, the ability to be self-directed may be developmental and may need to be influenced by faculty throughout the PT curriculum. Perhaps the best way to achieve this is through gradual dosing of self-directed learning situations and demands during the first year, culminating in a PBL course when the foundational, factual information has been assimilated. The GVSU PT faculty may need to be more transparent with our reasons for using nontraditional methods and affirm the discomfort and feelings that occur with implementation of such methods.

If PT students tend to be concrete-sequential (or some combination of CS and another type) in their orientation (Olson & Scanlon, 2002), they may need to be stretched or influenced to become more abstract in their learning styles. This can be achieved overtly with suggestions, demands, and learning tasks designed to demonstrate the necessity of abstract thinking and covertly by weaving abstract reasoning and skills into lecture-based courses, assignments, and objectives. Perhaps students can be persuaded to alter or *mature* their learning preferences if they are convinced that it will benefit them in their careers. Progressive learning-style influences and challenges may be helpful for

promoting students' alterations of their perceptions regarding a teaching/learning environment.

Educators need to understand the strengths and weaknesses of approaches such as SDL and PBL. Although faculty support the need for SDL, the skills that students require for becoming self-directed, the methods for acquiring these skills, and faculty-led activities that foster self-directed learning are poorly described for the profession of PT. Given that students are likely to be unfamiliar with PBL and SDL types of instruction, attention must be paid to the introduction of such methods. Previous literature reports that students are most comfortable with new methods when given sufficient time to assimilate the processes, demands, and expectations of such nontraditional methods (Albanese & Mitchell, 1993; Vernon & Blake, 1993). In the current study, many subjects offered evidence of similar feelings in statements such as *“It took me more than half the semester to finally understand...this is what I was supposed to do”*; *“I think that we were just thrown into it”*; and *“my biggest frustration [was] I wanted to learn, I wanted to study, I just didn't know how to go about doing it”* [italics added]. Consequently, the GVSU faculty must do a better job of assisting students in making the transition from more traditional instructional methods to less traditional methods. The faculty must also provide ample instruction in the outcomes expected from students in less traditional learning experiences.

Faculty must acknowledge that learner preferences affect learner satisfaction. Faculty must be flexible and fluid in their choice of methods and use a variety of methods in order to attempt to match learner preferences. Expectations for students in all courses must be clear and perhaps even clearer for PBL courses and SDL experiences. Finally,

organization and structure were important to the students examined in the current study and should be considered important in all course development and delivery. Lack of organization was frustrating for students and was accompanied by feelings of lack of success.

Limitations

Several limitations present in the current research need to be discussed and will then be used for the discussion of suggestions for future research.

The current study used a convenience sample of the GVSU class of 2006. The performance and perceptions of these students may not represent those of other students in other GVSU programs or in PT schools throughout the United States or abroad.

The students in the current study were studied only in their first curricular year. The results of this study may not be the same as they would be if the students were studied over the entire curriculum.

The quantitative tool used to examine change in CT may not have been specific enough to the discipline of PT to demonstrate practical change in PT students. Several previous authors have reported specificity as a potential problem with the WGCTA (Slaughter et al., 1989; Vroman & MacRae, 1999; Daley, et al., 1999; Wilson, 2000). Consequently, the students' actual CT related to the practice of PT may not be measured accurately by the WGCTA. Whether students took time and answered questions thoughtfully on quantitative tests and questionnaires cannot be determined. However, the responses on the one negative item used in the additional questionnaire suggest that students did read questions carefully enough to answer with discrimination.

No critical change values for the SDLRS-A have been reported in the literature. Therefore, although the scores on this standardized test declined for the GVSU PT students in the current study, it is unknown whether these declines are practically significant.

Finally, the consistency in implementation of any type of instructional method could not be assured, as the courses were taught by several faculty members. Implementation of alternate teaching strategies is likely to have differed among instructors and could not be controlled.

Suggestions for Future Research

First and foremost, the construct of CT in PT must be investigated and described. Unfortunately, such a process is not simple or quick. A process like the Delphi study used in the profession of nursing study (Scheffer & Rubenfeld, 2000) to develop a consensus statement about critical thinking may be the place to start. The profession of PT would be well served to develop consensus. Such a descriptive statement with key indicators could form the basis for future research into the development of CT. A responsive, excellent assessment tool of CT could be developed and used for research on both PT students and practicing PTs. If a tool to measure CT in PTs were developed, a multiple site study could be conducted to examine a broader population of PT students.

In lieu of such a tool's being developed, the study could be repeated, with the CCTST or the CCTDI. Although the previous evidence regarding the use of these tools with PT students is limited, the CCTDI may offer the most potential. The CCTDI was reported by Bartlett and Cox (2002) to be useful for monitoring individual change and

evaluation of the effectiveness of a program in enhancing CT abilities among PT students.

It would also be interesting to study the effect of a structured, highly overt orientation to and integration of PBL and other SDL approaches later in the curriculum versus in the first semester. The logic for this suggestion comes from the current timing of the implementation of nontraditional methods. Perhaps students would feel more comfortable with an alternate approach to instruction after an orientation to the curriculum and PT jargon. Likewise, baseline familiarity with PT examination tools, methods, and other foundational content may allow for better preparation for different, less familiar learning methods. PBL may be best used for higher order thinking and integration of base knowledge, which may occur later in the curriculum than the first year.

Another suggestion for future research is to study students over their whole curricular experience, as did Vendrely (2005), and determine their overall satisfaction (using quantitative and qualitative methods). The results from a study such as this may or may not differ from the performance and perceptions of students in the first year alone. The possibility of using the same tools as those used in the current study to collect these data exists, as the PT class of 2006 and the researcher are available for a final administration of the quantitative tests and another set of focus-group interviews.

Another method for studying instructional methods would be to offer a single course in two sections, one traditional section using lecture and coordinated lab and another, nontraditional section that uses PBL or another nontraditional method, to compare learning outcomes and student satisfaction.

Finally, it may be interesting and informative to study and compare the outcomes of CT and SDL between a mixed-design curriculum and an entirely PBL curriculum. Although this suggestion sounds promising, it seems highly unlikely that two parallel curricula could run in the same institution. Therefore, it may be necessary to attempt to compare outcomes between two similar institutions, one with a mixed-design curriculum and one with a totally PBL curriculum for PT education.

Final Comments

Critical thinking and self-directed learning are important characteristics of the successful physical therapist. Educators in the field of PT must continually explore and examine methods used for developing these characteristics in their students. The perceptions of the students in a PT professional education program are important and should influence ongoing assessment of and development of PT curricula. Therefore, the students of the GVSU PT class of 2006 were studied to determine their performance and perceptions within the first year of the GVSU mixed-design curriculum.

Little practical difference was demonstrated in CT during the first curricular year as measured by the WGCTA. A decrease in SDL was demonstrated by the scores on the SDLRS-A over the first year of the GVSU PT curriculum, although it could not be determined whether this decline was practically significant. Results from the current study support the suggestions that the construct of CT should be studied and a responsive tool for evaluating CT in the PT student should be developed.

Students' qualitative responses gave rise to three distinct themes (Teaching and Learning process, Framework for Content Delivery, and Perceptions and Insights), in which they expressed a preference for more traditional modes and practices of learning

and less affinity for nontraditional methods. They commented on the framework for content delivery, describing their preferences for organization, some amount of repetition, and integration within semesters of the curriculum. They expressed concern over the volume and pace of the information taught in the first curricular year. Students offered their perceptions and insights related to the first-year experience with several qualitative, descriptive subthemes. These subthemes revealed a desire for feedback and guidance, the general preferred learning styles of students, and strong feelings of stress and anxiety regarding their performance and success or lack thereof.

Further research is needed to determine the relationship between teaching, learning, and the development of CT and SDL. Using the knowledge gained from the current study, the GVSU PT faculty should continue to critically examine the first curricular year as the time when nontraditional methods are introduced in the curriculum. Perhaps students could be better prepared and more ready to learn using nontraditional methods later in the curriculum. Because curriculum is constantly being assessed and revised, the faculty need to respond to the feedback and outcome performance of the students and attempt to continually improve the educational product being offered.

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APPENDICES

Appendix A: First-Year Physical Therapy Curriculum at Grand Valley State University

Fall (semester 1)

PT 481 Clinical Kinesiology+
HS 427 Neuroanatomy**
HS 461 Prosected Regional Anatomy**
SHP 408 Professional Roles/Issues in Healthcare+
PT 418 Physical Therapy Procedures I**
PSY 368 Psychology of Physical Disabilities**

Winter (semester 2)

MOV 380 Clinical Exercise Physiology**
PT 420 Differential Diagnosis in Orthopedic PT+
PT 421 Clinical Education I**, +
PT 422 Physical Therapy Procedures II**
PT 425 Clinical Medicine I **
PT 482 Clinical Biomechanics+

Spring/Summer (semester 3)

PT 428 Clinical Education II *
HS 428 Neurosciences **
SHP 419 Neuromuscular Development and Control **
SHP 510 Introduction to Health Professions Research +

* Taught by placement in Physical Therapy Clinics

**Taught in “traditional” lecture/laboratory format.

+ Taught in primarily “nontraditional” formats including: problem-based learning, discussion, or strongly case-based format.

Appendix B: Additional Questionnaire for use with Course Evaluations

Additional Course Questionnaire for First Year PT Students

1. Circle the **one** teaching methodology that most closely describes the majority of the teaching methods used in the classroom portion of this course

Lecture Lecture/Discussion Case-based learning Problem-based learning
Laboratory based/Hand on

2. Circle the **one** teaching methodology that most closely describes the majority of the teaching methods used in the laboratory portion of this course (if applicable)

Lecture Lecture/Discussion Case-based learning Problem-based learning
Laboratory based/Hand on

For the following questions answer using the following key:

A= Strongly Agree, B= Agree, C= Neither Agree nor Disagree, D= Disagree, E= Strongly Disagree

- | | | | | | |
|---|---|---|---|---|---|
| 3. The teaching methods used in this course to deliver content helped me master the course content. | A | B | C | D | E |
| 4. I enjoy learning in the modes/methods used in this course. | A | B | C | D | E |
| 5. The teaching methods used in this course were my favorite. | A | B | C | D | E |
| 6. I am uncomfortable with the teaching method(s) used in this course. | A | B | C | D | E |
| 7. I am prepared to handle the type of instruction I have encountered in this course. | A | B | C | D | E |

Appendix C: Questions Used During Focus Group Sessions

This focus group is designed to understand your views and perceptions of the first year of the GVSU PT program. I will be asking questions related to your overall experience in the PT program during the first year. Please feel free to make comments that describe your experience, feelings, and perceptions, and be ready to give examples that support your ideas. Please try to avoid specific content areas within the curriculum, rather focus on whole courses or semester experiences if at all possible.

1. Describe a learning experience within this first year of the PT program that matched your preferred learning style. What made it a good match? How would you describe your preferred learning style?
2. Describe an experience in this first year of the PT program that left you feeling dissatisfied about whether you learned the content you needed to know. What made this experience stand out for you?
3. Describe an experience in this first year of the PT program that left you feeling satisfied that you learned the content you needed to know. What made this experience stand out for you?
4. Please share any additional information or opinions that you may have about the first year curriculum with me. Please give examples to illustrate ideas that you have.

Appendix D: Grand Valley State University End-of-Course Evaluation

ID NUMBER										SPECIAL CODES										
										A	B	C	D	E	F	G	H	I	J	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

GENERAL PURPOSE DATA SHEET II
form no. 70921

USE NO. 2 PENCIL ONLY

Grand Valley State University Faculty Evaluation Form

Course: _____ Section: _____

Yr: _____ Semester: _____

Instructor: _____

Strongly Disagree E

Disagree D

Neither Agree nor Disagree C

Agree B

Strongly Agree A

BACKGROUND INFORMATION

- 1 Class standing: a. Freshman b. Sophomore c. Junior d. Senior e. Grad/other
- 2 This course was: a. GenEd b. Major requirement c. Minor requirement d. Elective
- 3 Expected grade in this course: a. "A" b. "B" c. "C" d. "D" e. "F"
- 4 Class size: a. fewer than 25 b. 25 - 40 c. 41 - 75 d. 76 - 100 e. greater than 100
- 5 Met with instructor during office hours or other times: a. Never b. 1-2 c. 3-4 d. 5 or more
- 6 I had considerable interest in this course at the beginning of the semester.
- 7 I had considerable interest in this course at the end of the semester.

COURSE & INSTRUCTOR EVALUATION

- 8 The amount of work was appropriate for the level and number of credit hours.
- 9 The course materials (syllabus, handouts, etc.) and requirements were very clear to me.
- 10 The sequence of topics in this course seemed logical to me.
- 11 My grades in this course accurately reflect my effort and learning.
- 12 The exams and other assignments made me think rather than just memorize.
- 13 The course was taught well.
- 14 I enjoyed taking this course.
- 15 I have benefited by having this instructor.

This instructor...

- 16 used a variety of effective methods and teaching techniques to promote learning.
- 17 maintained control and direction of the class.
- 18 used effective questioning and discussion skills that stimulated my thinking.
- 19 was well prepared and organized in teaching this course.
- 20 used appropriate analogies and examples to explain important concepts and terms.
- 21 was genuinely interested in students' learning and understanding.
- 22 exhibited enthusiasm and confidence.
- 23 used a teaching style that kept my attention throughout this course.
- 24 used current issues or personal experience to clarify topics.
- 25 knew the subject matter well enough to teach it to others.
- 26 was fair and impartial in evaluating students in this course.
- 27 presented material audibly and clearly.
- 28 treats students with respect.
- 29 used the board, overhead projector and other teaching aids effectively.
- 30 graded and returned assignments and exams promptly.
- 31 was readily available to meet with students outside of class.
- 32 was patient with students who did not immediately understand the topic.
- 33 motivated me to do my best work for this class.
- 34 was flexible and willing to adjust the pace and teaching style if necessary.

Write-in 1 on back. Describe ways your instructor has been effective.

Write-in 2 on back. Describe ways your instructor could be more effective.

Write-in 3 on back. Describe ways this course could be improved.

Appendix E: Human Subjects Institutional Review Board Approval



EASTERN MICHIGAN UNIVERSITY

09/08/03

Barbara Hoogenboom
Department of Leadership and Counseling

RE: *"Student Perceptions and Performance within the first year of a mixed Physical Therapy Curriculum."*

The Human Subjects Institutional Review Board (IRB) of Eastern Michigan University has granted approval to your proposal, "Student Perceptions and Performance within the first year of a mixed Physical Therapy Curriculum."

After careful review of your application, the IRB determined that the rights and welfare of the individual subjects involved in this research are carefully guarded. Additionally, the methods used to obtain informed consent are appropriate, and the individuals are not at a risk.

You are reminded of your obligation to advise the IRB of any change in the protocol that might alter your research in any manner that differs from that upon which this approval is based. Approval of this project applies for one year from the date of this letter. If your data collection continues beyond the one-year period, you must apply for a renewal.

On behalf of the Human Subjects Committee, I wish you success in conducting your research.

Sincerely,

A handwritten signature in blue ink that reads "Patrick Melia".

Dr. Patrick Melia
Administrative Co-Chair
Human Subjects Committee

CC: Dr. Charles Achilles
Dr. Steve Pernecky, Faculty Co-Chair

Appendix F: Informed Consent Document
INFORMED CONSENT FORM:

“Student Performance and Perceptions within the first year of a Mixed Physical Therapy Curriculum”

I agree to participate in the above stated research project by completing two assessment tools (at two separate administration times) and a brief questionnaire at the completion of each course taken within the first year of the Grand Valley State University Program in Physical Therapy. Barbara Hoogenboom will conduct this research as a part her doctoral dissertation research at Eastern Michigan University.

Participation in this study has no foreseeable risks or benefits to the subjects.

I understand that I will be asked questions (either in the form an assessment tool or questionnaire) that relate to my own personal characteristics and my experiences within the first year of the Grand Valley State University Physical Therapy Program. I understand that I will also be asked questions about my age, sex, undergraduate degree and preferred learning style. I further understand that I may choose not to answer any questions if I do not wish to do so.

I understand that my participation in this research is voluntary. I understand that I may choose to withdraw from the study at any time if I wish to do so, without any penalty. By agreeing to participate in this research I understand that my confidentiality will be protected at all times. I understand that my actual name will not be used in any written or oral report without my express, written permission. In all other cases anonymous excerpts will be used in the written dissertation document or any publications that may result. I understand that I may request a copy of my assessment results.

If I have any further questions about this research or its’ administration I may contact Barbara Hoogenboom (the researcher) or I may contact the researcher’s chairperson, Charles Achilles, EdD. Their contact information is as follows:

Barbara Hoogenboom MHS, PT, SCS, AT,C.
(616) 331-2695 (work)
(616) 897-8858 (home)

Grand Valley State University
366 Center for Health Sciences
Grand Rapids, MI 49503

Charles Achilles, EdD
(734) 487-7120, ext. 2679

Eastern Michigan University
304 Porter Building
Ypsilanti, MI 48197

Subject _____

Date _____

Researcher _____

Date _____