Fall 1999

Problem-based learning in athletic training education

Kerri-Ann Catlaw

University of New Hampshire, Durham

Follow this and additional works at: https://scholars.unh.edu/dissertation

Recommended Citation

https://scholars.unh.edu/dissertation/2091

This Dissertation is brought to you for free and open access by the Student Scholarship at University of New Hampshire Scholars' Repository. It has been accepted for inclusion in Doctoral Dissertations by an authorized administrator of University of New Hampshire Scholars' Repository. For more information, please contact nicole.hentz@unh.edu.
Problem-based learning in athletic training education

Abstract
The purposes of the study were first to identify the frequency and the degree to which athletic training educators employed Problem Based Learning (PBL), its variants, and traditional methods in their teaching; and second to solicit educators' judgments of the quality of educational outcomes in their coursework. A survey instrument was distributed to a random sample of 101 CAAHEP accredited curriculum athletic training educators. Eighty-three subjects returned the instrument, yielding a response rate of 82%. The survey contained 20 closed-response items and 3 open-response items, and was divided into three sections highlighting demographic information, teaching methods, and educational outcomes. The teaching method section was subdivided into PBL method items and traditional teaching method items. These groups of items were selected both conceptually and by factor analysis. Respondents were placed into a PBL group or a Non-PBL group according to their scores on the teaching method items. Descriptive statistics were generated for all of the responses. Demographic background and educational outcome judgements were compared between the PBL and the Non-PBL groups using non-parametric statistics. The results revealed that although only a small number of athletic training educators are using all of the PBL methods identified in the survey, the majority of athletic training educators are using one or more elements of PBL during a typical week of teaching. The findings also demonstrated that athletic training educators are employing other innovative methods in addition to PBL to complement or replace traditional teaching methods. Overall, all athletic training educators, both those that use PBL and those that use traditional teaching methods, have favorable opinions and attitudes toward the effectiveness of their methods. There was found, however, a significant difference ($p < .03$) between the distribution of scores on outcome items of the PBL faculty and Non-PBL faculty, suggesting that PBL faculty have more favorable opinions and attitudes toward their teaching method than the Non-PBL faculty. In conclusion, PBL is prevalent in athletic training education and faculty who report using several important aspects of PBL also report greater satisfaction with their students' learning outcomes.

Keywords
Health Sciences, Recreation, Education, Higher, Education, Teacher Training, Education, Physical

This dissertation is available at University of New Hampshire Scholars' Repository: https://scholars.unh.edu/dissertation/2091
INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

Bell & Howell Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
PROBLEM BASED LEARNING
IN
ATHLETIC TRAINING EDUCATION

BY

KERRI-ANN CATLAW

B.S.E. Cortland State College, 1992
M.Ed. University of Virginia, 1994

DISSERTATION

Submitted to the University of New Hampshire
in Partial Fulfillment of
the Requirements for the Degree of

Doctor of Philosophy

in

Education

September, 1999
This dissertation has been examined and approved.

Dissertation Co-director, Grant L. Cioffi, Ph.D.
Associate Professor of Education

Dissertation Co-director, Robert W. Kenefick, Ph.D.
Assistant Professor of Kinesiology

Charles H. Ashley, Ed.D.
Associate Professor Emeritus of Education

Linda Carpenter, Ph.D., J.D.
Brooklyn College
Professor Emerita of Physical Education and
Exercise Science

Joseph J. Orosko, Ph.D.
Associate Professor of Education

June 30, 1999
Date
DEDICATION

To my father, Ken, for his constant support and belief in me, and for always having those encouraging words which have inspired me to achieve my every dream.

And

To my husband and soul mate in life, Darryl, for giving me the greatest gift of my life – his love.

In memory,

Of my grandfather, Dr. J. Kenneth Catlaw, who I came to know through the memories of others, and in so, his life has inspired my academic accomplishments.
ACKNOWLEDGEMENTS

I was once told by a dear friend that “obstacles are what you see when you take your eyes off of your dreams.” I have been fortunate in life in that I have been surrounded by special people who have supported me in such a way that it was easy to keep my eyes on my dreams; one dream being the completion of my doctorate. There are many people I wish to acknowledge for their importance in my life and for their contribution to the completion of this project.

I would first like to thank my committee members, Charlie Ashley, Linda Carpenter, Grant Cioffi, Bob Kenefick, and Joe Onosko, for their support and guidance throughout this endeavor. The unique attributes of each one of these professionals played a vital role in the development of this project. I wish to extend a special thanks to my committee co-directors, Grant and Bob, for the time they invested into shaping me as a “researcher”, as well as for their caring, patience, and constant encouragement.

I would like to take time to thank two well-respected professionals in the field of athletic training who I am fortunate to have had as mentors along my journey in life, John Cottone and Dan Sedory. I am grateful to each of these men for their constant support and belief in me, and especially for their invaluable insight concerning my career as an athletic trainer.

I would like to thank the members of my favorite “rah, rah” group from UNH, particularly, Jean Mitchell, Joanne Maldari, Bob Kertzer, Tim Quinn, Ron Croce, John Miller and Mike Gass, for their genuine interest and strong support.

v

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
I wish to extend my sincere appreciation to the Physical Education and Exercise Science faculty/staff at Brooklyn College for their warm support, constant encouragement, and valuable assistance in helping me accomplish this task.

I would like to thank my family, both old and new, for their love, support and encouragement. Special thanks to the Berleth family, especially Mombi, Popsy, and Mona, for being the most loving, caring, and genuine people I ever had the pleasure of knowing. I would like to thank my brother, Ken, for his friendship and support, and for sticking with me through the times. I also want to thank my best friend, Kristen, for helping me maintain a positive outlook throughout this project and for being everything you look for in a friend.

Most of all, I am deeply indebted to the athletic training educators who participated in this study. Through this experience, I found the eagerness among athletic training professionals to assist one another in her/his professional development to be truly remarkable.

I would like to close with a general note of thanks to all of the people in my life who, individually and collectively, have empowered me to accomplish this task.
# TABLE OF CONTENTS

DEDICATION .................................................................................................................. iv  
ACKNOWLEDGEMENTS ............................................................................................. v  
LIST OF TABLES ........................................................................................................... ix  
LIST OF FIGURES .......................................................................................................... x  
ABSTRACT ...................................................................................................................... xi  

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>II. REVIEW OF THE LITERATURE</td>
<td>14</td>
</tr>
<tr>
<td>Introduction to Problem Based Learning</td>
<td>14</td>
</tr>
<tr>
<td>PBL in medical and allied health programs</td>
<td>15</td>
</tr>
<tr>
<td>Criticisms of the traditional approach</td>
<td>18</td>
</tr>
<tr>
<td>Implementation of PBL</td>
<td>20</td>
</tr>
<tr>
<td>Components of PBL</td>
<td>22</td>
</tr>
<tr>
<td>Essential characteristics</td>
<td>22</td>
</tr>
<tr>
<td>Learning process</td>
<td>26</td>
</tr>
<tr>
<td>Variations in method</td>
<td>34</td>
</tr>
<tr>
<td>Outcomes</td>
<td>37</td>
</tr>
<tr>
<td>Summary</td>
<td>48</td>
</tr>
<tr>
<td>III. METHODOLOGY</td>
<td>50</td>
</tr>
<tr>
<td>Population and sample</td>
<td>50</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>52</td>
</tr>
<tr>
<td>Data collection procedure</td>
<td>56</td>
</tr>
<tr>
<td>Data analysis</td>
<td>57</td>
</tr>
<tr>
<td>Teaching method subscales</td>
<td>58</td>
</tr>
<tr>
<td>Identifying PBL and non-PBL respondents</td>
<td>60</td>
</tr>
<tr>
<td>IV. RESULTS</td>
<td>61</td>
</tr>
<tr>
<td>Survey instrument and population sample</td>
<td>61</td>
</tr>
<tr>
<td>Demographic profile</td>
<td>61</td>
</tr>
<tr>
<td>Research question one</td>
<td>68</td>
</tr>
<tr>
<td>Research question two</td>
<td>70</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conceptual Outline of PBL Survey Items</td>
</tr>
<tr>
<td>2</td>
<td>Intercorrelation Matrix for Teaching Method Items</td>
</tr>
<tr>
<td>3</td>
<td>Factor Analysis of Teaching Method Items</td>
</tr>
<tr>
<td>4</td>
<td>Demographic Characteristics</td>
</tr>
<tr>
<td>5</td>
<td>Means and Standard Deviations of PBL Method Items</td>
</tr>
<tr>
<td>6</td>
<td>PBL Item Statistics</td>
</tr>
<tr>
<td>7</td>
<td>PBL Group Ratings on Outcome Items</td>
</tr>
<tr>
<td>8</td>
<td>Non-PBL Item Statistics</td>
</tr>
<tr>
<td>9</td>
<td>Other Methods Employed by Athletic Training Educators</td>
</tr>
<tr>
<td>10</td>
<td>Non-PBL Group Ratings on Outcome Items</td>
</tr>
<tr>
<td>FIGURE</td>
<td>PAGE</td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>1</td>
<td>Comparison between PBL and Non-PBL on Outcome Items</td>
</tr>
<tr>
<td>2</td>
<td>Opinions and attitudes of PBL and Non-PBL Athletic Training Educators on the Effectiveness of Their Teaching Methods</td>
</tr>
</tbody>
</table>
ABSTRACT

PROBLEM BASED LEARNING
IN ATHLETIC TRAINING

By

Kerri-Ann Catlaw

University of New Hampshire, September 1999

The purposes of the study were first to identify the frequency and the degree to which athletic training educators employed Problem Based Learning (PBL), its variants, and traditional methods in their teaching; and second to solicit educators' judgments of the quality of educational outcomes in their coursework. A survey instrument was distributed to a random sample of 101 CAAHEP accredited curriculum athletic training educators. Eighty-three subjects returned the instrument, yielding a response rate of 82%. The survey contained 20 closed-response items and 3 open-response items, and was divided into three sections highlighting demographic information, teaching methods, and educational outcomes. The teaching method section was subdivided into PBL method items and traditional teaching method items. These groups of items were selected both conceptually and by factor analysis. Respondents were placed into a PBL group or a Non-PBL group according to their scores on the teaching method items. Descriptive statistics were generated for all of the responses. Demographic background and educational outcome judgements were compared between the PBL and the Non-PBL groups using non-parametric statistics. The results revealed that although only a small number of athletic training educators are using all of the PBL methods identified in the...
survey, the majority of athletic training educators are using one or more elements of PBL during a typical week of teaching. The findings also demonstrated that athletic training educators are employing other innovative methods in addition to PBL to complement or replace traditional teaching methods. Overall, all athletic training educators, both those that use PBL and those that use traditional teaching methods, have favorable opinions and attitudes toward the effectiveness of their methods. There was found, however, a significant difference (p<.03) between the distribution of scores on outcome items of the PBL faculty and Non-PBL faculty, suggesting that PBL faculty have more favorable opinions and attitudes toward their teaching method than the Non-PBL faculty. In conclusion, PBL is prevalent in athletic training education and faculty who report using several important aspects of PBL also report greater satisfaction with their students’ learning outcomes.
CHAPTER I

INTRODUCTION

The athletic training profession has recently undertaken remarkable strides to reform its professional educational standards. Athletic trainers are allied health professionals responsible for the prevention, emergency care, management, treatment, and rehabilitation of all injuries/illnesses incurred by the physically active. In order to gain an appreciation for this current educational reform, it is first necessary to present a history of the evolution of athletic training education. The growth and development of athletic training education has been closely intertwined with the development of the athletic training professional organization, the National Athletic Trainer's Association (NATA), which was founded in 1950 (Delforge and Behnke, 1999). Both athletic training education and the NATA have been evolving over the past fifty years.

The original athletic training curriculum model, adopted in 1959, contained the basic course work taken in physical education, with the addition of minimal course work in athletic training, course work leading to teaching certification, and prerequisite course work for physical therapy schools. In 1969 the NATA approved the first athletic training curriculums after drafting a governance document that outlined guidelines for approval. Shortly after this event, the NATA developed and implemented a national certification examination. Individuals graduating from an NATA approved undergraduate curriculum were eligible to take the national certification exam, as well as those individuals who...
completed an apprenticeship program, a physical therapy program, or on the job training as an athletic trainer for more than five years. The adoption of the undergraduate NATA approved curriculum and the implementation of a National Athletic Trainer’s Board of Certification (NATABOC) examination provided a foundation for athletic training education.

The past decade marks the most significant changes in the athletic training profession. These changes began with the NATA Board of Directors recommendation to pursue curriculum accreditation by the American Medical Association (AMA) Committee on Allied Health Education and Accreditation (CAHEA). The profession first had to seek recognition as an allied health profession from the AMA Council on Medical Education (CME) before pursuing accreditation by CAHEA. The AMA officially recognized athletic training as an allied health profession in June of 1990, and with this recognition came a new professional status in the health care community for athletic trainers (Delforge and Behnke, 1999). The next step was the formation of the Joint Review Committee on Educational Programs in Athletic Training (JRC-AT) which developed the standards and guidelines, in agreement with the AMA and other co-sponsoring professional organizations, that would govern the CAHEA accreditation of an entry-level athletic training curriculum. The JRC-AT reviews athletic training programs using these standards and guidelines, the Essentials and Guidelines for an Accredited Educational Program for the Athletic Trainer (CAHEA, 1991), along with the athletic training educational objectives outlined in the Competencies in Athletic Training (NATA, 1983), in making a decision to recommend a program for CAHEA accreditation. In 1994, the first athletic training programs were accredited by CAHEA and currently

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
there are over 82 accredited undergraduate athletic training educational programs, who are now accredited by the Commission on Accreditation of Allied Health Educational Programs (CAHEA disbanded and CAAHEP was formed).

Another important event occurred in 1994. The NATA created an Educational Task Force that was charged with evaluating all aspects of athletic training education including undergraduate, graduate, continuing education, and future implications (NATA, 1996). This committee was formed to address specific concerns in the athletic training profession. Several concerns surrounded the inconsistency of the educational preparation of an entry-level athletic trainer. Athletic trainers, unlike any other allied health profession, could attain national certification via two different educational routes: through coursework addressing a prescribed curriculum or through on the job training as an intern. The athletic training curriculum programs meet educational standards for accreditation and address specific content areas covered in the Competencies in Athletic Training. The internship programs are not driven by educational competencies or standards but do require students to acquire 1500 clinical experience hours. Both routes grant students eligibility to sit for the national certification exam after completion of a baccalaureate degree.

These separate routes to certification have been the cause of much confusion. With two, not only separate, but totally different routes to certification, the quality of the education that an entry-level athletic trainer would possess is questionable. This has made it difficult in a time of health care reform for athletic trainers to justify their role as a health care provider to legislators and the health care community, and to secure state licensure and to claim third party reimbursement. This inconsistency in the educational
preparation of athletic trainers was one of the major educational issues addressed by the Educational Task Force. The Educational Task Force began with a list of 89 educational issues which they narrowed down to the following 14 (NATA, 1996, p. 22-23):

1. Need for more consistent preparation of the entry-level athletic trainer.
2. Need to address the divergent scores occurring on the NATABOC certification examination.
3. Need to prepare entry-level athletic trainers in the context of a rapidly expanding body of knowledge.
4. Need to ensure entry-level preparation in the context of strong institutional support for athletic training education.
5. Need to improve the consistency and quality of athletic training instruction.
6. Need for an alternate route (graduate program) to enter the profession.
7. Need to provide the intellectual resources to ensure an expanding body of knowledge in athletic training.
8. Need to provide quality athletic training education “across the life span”.
9. Need to assure continuing competence of practicing athletic trainers.
10. Need to recognize special competence.
11. Need to prepare athletic trainers for post entry-level competencies required in specialized settings.
12. Need for professional advocacy of education “across the life span” through a common voice.
13. Need to address a potential diminishing employability of athletic trainers prepared via the internship route to certification.
14. Need to streamline the educational functions of the NATA.

After almost two years of deliberation, the Educational Task Force proposed 18 recommendations to address the above issues initiating the reform of athletic training education. It is important to identify several of these educational reform recommendations along with the implications for athletic training professionals. The first recommendation proposed was the consolidation of the curriculum and internship programs into one standardized athletic training educational program accredited by CAAHEP. Beginning in January 2004, all athletic training students must graduate with a baccalaureate degree from a CAAHEP accredited athletic training educational program in order to be eligible to take the NATABOC examination. This recommendation calls for the abandonment of the internship route, giving the current students enrolled in the internship programs until December 2003 to qualify for the certification exam. This change will standardize the quality of the educational preparation of the entry-level athletic trainer, making athletic training preparation comparable to other allied health professions.

The adoption of one educational route to certification eligibility will change the role of athletic training professionals involved in athletic training education. Currently, there are many more internship programs than curriculum programs. The termination of the internship programs will result in a limited number of higher education institutions offering an athletic training education. The athletic training educators at the colleges/universities hosting the internship programs will be faced with a decision to develop a curriculum suited for CAAHEP accreditation or to abandon the notion of providing athletic training education. The transformation of an internship program into a
CAAHEP accredited curriculum is a difficult task and poses new challenge to educators accustomed to teaching in trade. The educators that decide to pursue accreditation will have to revamp their curriculum to address the specific content areas outlined in the Competencies in Athletic Training. This would require an emphasis on structured athletic training courses in addition to clinical education. The educators from the internship programs, as well as all athletic training educators, could benefit from research pertaining to athletic training education, specifically on instructional methods.

Another recommendation made by the Educational Task Force, currently in effect, advocated the creation of an Educational Council “to act as THE voice for educational policy, development, and delivery in our profession” (NATA, 1996, p. 26). Since their inception, the Educational Council has worked to transform the recommendations of the Educational Task Force into action. One result of the Educational Council’s actions is a complete revision of the 191 educational competencies that have historically guided athletic training education. The Educational Council has restructured the educational competencies to encompass new educational domains and outline specific content areas. The new Competencies in Athletic Training will come into effect September 2001 for athletic training educational programs seeking CAAHEP accreditation.

The Educational Council has implemented changes in clinical education as well. Previously, an athletic trainer qualified as a clinical instructor if she/he was certified for one year or more. Under the new educational guidelines, an athletic trainer must undergo a certification process to work as a clinical instructor. The underlying purpose of a clinical instructor certification process is to monitor the quality and consistency of
clinical education. The adoption of one route to certification, revision of educational competencies, and the implementation of new standards and guidelines for clinical education are all part of the educational reform that will create a consistent educational system that parallels other allied health professions. These changes that have occurred so rapidly have a direct impact on athletic training educators. The educators are the individuals now responsible for developing a body of course work to address the new educational competencies and for adhering to new clinical educational guidelines. Athletic training educators also have to select and to employ appropriate educational methods in order to successfully deliver the knowledge base outlined in the competencies and ensure preparation of the entry-level athletic trainer.

The on-going reform of athletic training education has identified a need for research in education. The NATA Research and Education Foundation (NATA-REF), formed in 1991, has promoted research in the area of education through the provision of grants. The NATA-REF has also sponsored a professional educator's conference designed for colleagues to share their educational strategies and for the Educational Council to keep the educators abreast of all changes in athletic training education. This conference has proved meaningful, but there continues to be a lack of educational research, specifically in the area of instructional methodology. Research on effective instructional methods could be useful for new educators or for those educators dissatisfied with their current methods. This type of research can begin with an investigation of methods currently employed by athletic training educators, and an evaluation of the educator's perceived effectiveness of the methods they employ. With a lack of research in athletic training education, it is logical also to investigate the literature
of related allied health educational programs and medical schools and examine their educational methods. One such method, historically implemented in medical schools, and currently utilized in many allied health educational programs, is known as Problem-Based Learning (PBL).

PBL is learning that is centered on an encounter with a problem, and is the "learning that results from the process of working toward the understanding or resolution of a problem" (Barrows and Tamblyn, 1980, p.1). While there is a range of definitions and variations of PBL presented in the literature, PBL at its most basic level is an educational method characterized by the use of problems as a context for students to learn (Albanese and Mitchell 1993). PBL as an educational method has been implemented in a variety of ways from use in a single course to use in an entire curriculum. For the purpose of this study, the scope of PBL will be defined by its implementation in a single course rather than across an entire curriculum. PBL as a curriculum-wide method would unlikely be found in athletic training education, whereas the individual use by educators in one or more of their courses is more probable.

Medical and allied health educational programs implemented the PBL approach to address specific concerns they had regarding the use of the traditional, or lecture-based, educational approach. The following four concerns linked with traditional teaching methods led educators to consider the PBL approach over the traditional approach: "the student’s long-term recall of basic science information is often poor; the student’s clinical reasoning process is often inappropriate, inaccurate, or inefficient; the student’s self-directed learning ability is often lacking;" and, the student’s interest and motivation for learning had declined (Rouse, 1990, p.111). As with medical students, athletic training
students are expected to draw on basic science knowledge they learned and apply it in a clinical context to the solution of patient problems. Not only is it imperative for students to have the ability to apply knowledge to the practical setting, but it is also important to have self-directed learning skills in order to stay adept in an ever-evolving and advancing medical world. PBL addresses these educational concerns and claims to meet the following educational objectives: structure knowledge for use in clinical contexts, develop an effective clinical reasoning process, develop self-directed learning skills, and increase the student’s motivation to learn (Barrows, 1986, p.481-482).

Many medical educators have investigated the effectiveness of PBL within and between medical curricula, and have compared the PBL approach with traditional techniques, examining a variety of outcomes such as performance on basic science examinations, performance in clinical rotations, performance on the medical board examination, and student and faculty interest and attitudes toward each teaching method. The majority of research comparing these two methods demonstrates little to no difference between PBL and traditional methods. Probable reasons for these inconclusive findings are the confounding variables present in many PBL and traditional programs, and the academic excellence of medical school students which enables their acquisition of required knowledge without consideration of its delivery. One disconcerting variable involved in the comparison of PBL with traditional programs is the experimental nature and heterogeneity of PBL programs (Bickley, 1993). The diverse approaches of PBL implementation, ranging from a complete curricular reform to use in a few courses, makes a comparison of the PBL approach and other methods quite difficult. Although the effectiveness of PBL as compared to traditional methods remains unclear, the
majority of studies indicate PBL is as equally effective as traditional methods, and that PBL is perceived as more enjoyable than traditional methods by students and faculty.

**Statement of the Problem**

Current research in athletic training education has focused on clinical education instruction and is limited in the area of instructional strategies. Athletic training educators can benefit from the experiences of other educators in athletic training as well as educators in related professions. It is important to identify both the instructional methods implemented by athletic training educators and the perceived outcomes of these methods. As previously stated, PBL is a method currently employed in medical and allied health educational programs, as well as other educational programs. PBL is applicable to athletic training education, and may currently be employed in athletic training educational programs throughout the United States. It is important to identify educators utilizing PBL, investigate the manner in which it is being implemented, and examine the outcomes of the PBL method in regards to the education of student athletic trainers. It is also meaningful to investigate whether a relation exists between the types of teaching methods used by a teacher and the demographic profile of that teacher, such as the typical number of students they teach per class. This research study will address the following questions:

1. **What is the frequency of CAAHEP accredited athletic training educators currently using the PBL method or a variation of PBL?**
2. **For those athletic training educators using PBL or a variation of PBL, what is their opinion and attitude on the educational outcomes of this method?**
3. **What other methods are athletic training educators employing in the education**
of their student athletic trainers?

4. For those athletic trainers using methods other than PBL, what is their opinion and attitude on the educational outcomes of these methods?

5. How are factors such as teaching background, typical class size, years of teaching, highest degree held, and percent of time dedicated to classroom teaching related to the type of teaching method used by an educator?

**Significance**

The significance of this research is two-fold: it will address a need for research in athletic training education and it will add a new dimension to the investigative literature on PBL. First, research in athletic training education is limited. There have been several studies on clinical education and learning styles of athletic training students, but there have not been any studies examining classroom educational methods. One study (Foster and Leslie, 1992) on clinical teaching roles indicated the need for future research on “master teachers of athletic training” and the need for examining the relationship between teaching roles and educational outcomes (p. 301). Another study in athletic training educational research by Fuller (1997) addressed critical thinking in athletic training and noted a need for investigation of instructional methods that may foster the students’ ability to become critical thinkers. This current study will identify the instructional methods of athletic training educators, “the master teachers,” teaching in CAAHEP accredited curriculums and will examine the outcomes of these methods as evaluated by the educator’s perceptions.

With the reform of athletic training education and the revision of educational competencies to encompass a broad spectrum of content areas, athletic training educators
find themselves in a position that is familiar to many other educators. Educators are trying to uncover an instructional strategy that will help them address the great quantity of information students must learn. Barrows (1983) claimed that there is no way medical schools could teach their students what they will need to know within a four-year period. This dilemma of effectively delivering a massive amount of information in a limited time period led to the search for alternative educational methods, such as PBL.

Currently, there are over 60 medical schools and many allied health educational programs that have adopted the PBL approach in whole or in part, and others are in the process of doing the same (Norman and Schmidt, 1992). There is reason to believe that athletic training educators may be utilizing PBL as an educational method. McLoda (1996) investigated the application of PBL in athletic training education and revealed that athletic training educators have a strong interest in PBL as an educational method. He stated that 75% of respondents indicated they were intrigued by PBL and thought it would be an asset to athletic training education. With a strong interest in PBL and with respondents agreeing on its applicability to athletic training education, it is likely that there are athletic training educators currently employing PBL. This research study will identify those athletic training educators utilizing PBL or a variation of PBL as a teaching method.

In addition to identifying the frequency of use of PBL in athletic training education, this study will evaluate PBL according to the perceptions of the educators using PBL. In spite of current use of PBL, the research is inconclusive in determining its effectiveness, especially in comparison with traditional teaching methods. The majority of research that investigators of PBL have had to rely upon is based on the innovative
medical schools that have PBL programs in existence. Until PBL is instituted in other allied health educational programs, the extent of research is limited either to medical schools or to short-term studies of other educational programs.

The effectiveness of PBL has been assessed using outcomes such as examination performance, clinical rotation performance and student interest. Vernon (1995) recognized a need for the research of medical faculty attitudes and opinions on the effectiveness of PBL. He designed a questionnaire outlining several educational outcomes, such as a student’s effective clinical reasoning skills and effective self-directed learning skills, and asked faculty to rate the effectiveness of PBL in attaining these outcomes. Vernon’s methodology is a feasible way to approach the investigation of PBL in the athletic training educational setting. In this respect, a survey can be used to identify the prevalence of PBL or a variation of PBL as a method in athletic training education and an assessment may be made on the faculty’s perceived outcomes of using the PBL method. The identification of PBL in athletic training education will open up further studies on PBL in yet another allied health profession; and, the assessment of the effectiveness of PBL based on athletic training faculty perceptions will add a new perspective to the existing literature on the effectiveness of PBL.
CHAPTER II

REVIEW OF LITERATURE

The purpose of this literature review is to centralize the scope of Problem-Based Learning (PBL) in order to understand the ensuing investigation. The content of this review comprises an in-depth summary of PBL, including an introduction to PBL in medical and health profession education, and a description of the components of PBL, with emphasis on the essential characteristics, learning process, variations in method, and outcomes. The following represents a depiction of PBL as it has been presented in the literature. There is only one study that investigated PBL in athletic training education, and this study focused on the applicability of PBL in athletic training education. With limited research on PBL in athletic training, the literature from medical education and allied health education was chosen as the primary source because of its related nature to athletic training education. Additional studies from the field of education were also used as a secondary source.

Introduction to Problem-Based Learning

The general principle of PBL is “to put learners in a particular situation, and then to give them a task or challenge as a source for learning, and arrange it to be of a kind similar to work with which they will be confronted in their professional future” (Walton and Matthews, 1989, p. 543). PBL is not a new educational strategy by any means; in fact, its educational roots can be dated well before its implementation in the McMaster
University Medical School in 1969. Many authors having researched the genesis of PBL have resolved that PBL derives from a long-standing educational concept as it is referenced in the writings of philosophers such as Socrates, Comenius, Dewey and Whitehead (Birch, 1986; Ezzat, 1990; Schmidt, 1995; Spaulding, 1969). These philosophers believed that students need ‘to learn how to learn’ with only the guidance of a teacher, and they can do so by using their knowledge in the context of a real-world situation or problem. Throughout the PBL research, statements such as “knowledge used is better remembered,” and “it is more important to consider how much the student learns than how much the teacher teaches,” depict this consistent theme or philosophy behind PBL (Barrows and Tamblyn, 1980, p. 16).

PBL in Medical and Allied Health Educational Programs

The medical curriculum at McMaster University in Ontario, Canada was one of the first programs to use PBL as a curricular approach. The McMaster PBL curriculum became a model that was used by many other medical schools as well as allied health educational programs, both national and international, as a guideline for implementation of PBL. Although these medical and allied health programs differ in their studies with education covering the scope of dentistry, pathology, physical therapy, optometry, occupational therapy, and nursing; they all share common educational objectives. These programs, unlike general education programs, are providing an education for each respective profession. Barr (1977) describes an education for a profession as one which “acquaints the learner with a particular profession, helps him develop specific attitudes consistent with that profession, provides opportunities to acquire knowledge and develop skills unique to the profession, and urges the learner to practice his profession and
continue his education..." (p. 263). In addition to educating for a profession, health profession schools are unique in that they are all governed by "state and national licensing boards, accrediting agencies, powerful professional societies, and certifying agencies" (Filerman, 1994, p. 47). Athletic training shares these unique features of a health profession education thus making the application of PBL in athletic training education conceivable. McLoda (1996) investigated the application of PBL in athletic training education and revealed that there is a strong interest in PBL as an educational method and that the applicability of PBL in athletic training is feasible. The implementation of PBL in athletic training has yet to be documented, and is one of the research questions driving this study. With a large number of these related programs using PBL as an educational strategy and the found interest of athletic training educators regarding PBL, it is reasonable to believe PBL has been or is used in athletic training education.

It has been suggested that the applicability of PBL across many medical and allied health programs can be attributed to the fact that these programs are all in the practice of educating students for a given health profession. It would then be reasonable to suggest that many of these related programs share similar concerns in regards to their educational practice and its effect on the outcomes of their graduating students. Graduates of any health profession will be called upon daily to use their knowledge and clinical reasoning skills to solve a specific problem within their respective profession, whether it is in athletic training or optometry. Health profession graduates will also be responsible for their continuing education in so that they may remain adept with the ever-changing health care system and with the changes and advancements within medicine. Therefore, the
requisites of the health profession graduates are that they possess the "commitment, skills, and a framework of knowledge that will sustain a lifetime of learning in medicine" (Tosteson, 1994, p. 108). Many health profession educators have long been concerned about the effectiveness of their educational strategies in the development of such a student. The concern of the effectiveness of the traditional curriculum and the teacher-directed, subject-based teaching/learning method resulted in the examination of the traditional curriculum, involving its design and its effectiveness in accomplishing health profession educational objectives.

Before examination of the traditional curriculum can be pursued, it is necessary to outline the educational objectives shared by many health profession educators. These objectives may have historically driven educational strategies, and they may have evolved through the investigation of educational strategies. We will assume that the former is more the case because just as a research question determines the method to be used, an educational objective should determine the instructional method to be used. The following presents a list of several proposed educational objectives (Barr, 1977; Barrows, 1983; Finucane, Johnson and Prideaux, 1998; Spaulding, 1969):

1. Students will acquire a knowledge base that is retained, structured in a clinical context, and integrated from many disciplines.
2. Students will develop clinical reasoning skills consistent with an expert in their respective profession.
3. Students will develop self-directed learning skills that will facilitate future learning.
4. Students will develop sensitivity, both medical and psychosocial, to patient's
5. Students will understand the relevance of their learning to their future career.

6. Students will be motivated to learn.

7. Students will develop their interpersonal skills and ability to work as a team member.

8. Students will develop independent, critical thinking skills.

With the educational objectives laid out, a critique of the traditional curriculum can ensue.

Criticisms of the Traditional Approach

Upon examining the traditional subject-based curriculum within the physical therapy literature, Barr (1977) concluded that the curriculum produced a fragmentation of knowledge, there was a lack of integration of that knowledge, and the curriculum was overloaded with courses. This is no surprise when one considers the vast amount of knowledge in medicine expected to be covered within a four-year curriculum. Tosteson (1994) states that the “corpus of potentially relevant information is too large for any individual to master during the medical school years” (p. 108). The curriculum becomes imposed with an unrealistic quantity of educational competencies that ultimately drives its educational purpose. Additional courses are designed within the curriculum to meet set competencies, resulting in an overloaded curriculum.

This notion of an overloaded curriculum has been described well in the secondary education literature as a “bloated curriculum” (Onosko and Newmann, 1994, p. 35). An overloaded or “bloated curriculum” emphasizes superficial understanding of a vast range of concepts, facts, ideas, etc., rather than sophisticated, in-depth understanding of less
material. Vast content coverage leads teachers to use teaching methods that efficiently deliver all of the necessary information in the allotted time, such as the teacher-directed lecture. An emphasis on breadth and the resultant use of teaching methods that transmit knowledge creates a situation which “allows little time for students to explore information, to reflect upon it, to recast it, to draw connections, to ask questions about it—in short, to think about rather than mindlessly absorb information” (Onosko and Newmann, 1994, p. 35). A steady diet of this type of instruction presents a major concern among educators regarding the quality of student produced. An overloaded curriculum does not embrace the medical and allied health educational objectives outlined above.

Other criticisms of the traditional approach were outlined by Finucane et al (1998). They stated that one criticism of the traditional curricular approach is it creates an “artificial divide” between the basic and clinical sciences (Finucane et al, 1998, p.445). Barr (1977) concluded this as well indicating that the traditional curriculum produces a fragmentation of knowledge, and there is a lack of integration of basic science knowledge and clinical science knowledge. The traditional approach does not structure knowledge in its clinical context nor does it provide a means for applying acquired basic science knowledge in its clinical context (Finucane et al, 1998). The students do not apply knowledge “learned” and therefore do not develop the clinical reasoning skills necessary for a practitioner. Rouse (1990) stated a concern of the traditional approach related to student performance is the student’s clinical reasoning process is often inappropriate, inaccurate, or inefficient.

Another criticism of the traditional approach is it is inefficient in that time is
wasted acquiring knowledge that is either forgotten or irrelevant (Finucane et al., 1998, p.445). This concern relates to the overloaded curriculum and the vast amount of knowledge that needs to be covered. It also relates to the criticism that the traditional curriculum does not structure knowledge in its clinical context. The superficial coverage of a vast amount of facts and the lack of integration of the basic and clinical sciences results in an often poor performance of the student’s long-term recall of basic science information (Rouse, 1990). Rouse (1990) also noted two other concerns of the traditional approach regarding student performance: the student’s self-directed learning ability was lacking; and, the student’s interest and motivation for learning had declined. These criticisms of the traditional curricular approach and the concerns regarding student performance impelled educators to consider the PBL approach over the traditional approach.

Implementation of PBL

The criticisms of the traditional educational method, especially the dissatisfaction with educational outcomes, have made PBL an attractive alternative with the research indicating that PBL has become somewhat of a ubiquitous approach in medical and allied health education. Jonas, Etzel, and Baransky (1989) investigated the prevalence of PBL in undergraduate medical schools in the United States and reported that 82 percent of these programs use PBL in some format in the teaching of the basic sciences. A percentage as high as 82 generates concern regarding the interpretation of the definition of PBL and the degree to which PBL is implemented within these programs. Walton and Matthews (1989) claim “that there is no fixed agreement as to what does or does not constitute PBL” (p. 542). There is also little agreement as to the most effective format
for the implementation of PBL. Different medical programs have employed PBL using
different formats ranging from a complete PBL curriculum innovation to the use of PBL
in the teaching of a unit or discipline of study (Branda, 1990). PBL is also commonly
implemented as a parallel track to the traditional track in medical schools allowing
faculty and students to select a preference.

Barrows, one of the founding fathers of PBL in medical schools, had intended the
PBL method to be used within units across a curriculum and not merely as an
instructional method in one or two courses within a curriculum. He felt that the PBL
method and the traditional lecture method were two methods in direct opposition and that
a curriculum utilizing both methods would place excessive demands on the students. If
students had to engage in both a course using PBL and a course using a lecture-style
method, the result could be a situation in which students are partaking in lengthy self-
directed study with PBL and at the same time memorizing a large body of facts from
lectures. With this in mind, Barrows and Tamblyn (1980) believe PBL should be “an all
or nothing” educational approach, with the all representing an entire curriculum driven by
PBL. In a PBL curriculum, educators do not use lecture to transmit knowledge. All
learning throughout the curriculum is centered on problems.

Schools that found it difficult or unattainable to reform an entire curriculum based
on PBL have implemented PBL as a track or in a course. Several studies found the
implementation of PBL to one course or one unit within the curriculum to be successful
(Martenson, Myklebust, and Stalsberg, 1992; Morrison and Murray, 1994; Scheiman and
Whittaker, 1990). The focus of this study is on PBL as an instructional method for use in
one or more courses within a curriculum. Barrows’ (1985) description of the PBL
Components of PBL

To develop a clear understanding of PBL, it is important to identify the multiple aspects of this educational approach. PBL can be divided into the following components: essential characteristics, learning process including facilitating conditions, variations in method, and outcomes.

Essential Characteristics

Teaching-learning methods. An essential characteristic of PBL is that it is student-centered and problem-based. Barrows and Tamblyn (1980) categorize teaching-learning methods in medicine in two ways. One category deals with the person responsible for deciding what the student will learn; it is either the teacher (teacher-centered) or the student (student-centered). There can be overlap within this category in which a lesson uses both student and teacher-directed methods. The other category is based on how the knowledge is organized; it is either by disciplines or subjects (subject-based), or it is centered on problems (problem-based). Again, there can be a situation in which a lesson is organized incorporating both subject matter and problems.

With student-centered learning, the students are responsible for being active in the learning process. They determine what they need to learn and how they are going to accomplish those learning goals. This does not imply that the teacher has no control over the educational objectives of the course. The teacher prepares a comprehensive scope of learning objectives for the course, outlines appropriate resources that can be used, and determines the course evaluation procedures. The unique feature of the student-centered
approach is the materials prepared by the teacher act only as a guideline for the students; the students develop their own learning strategies. The teacher's role in PBL is considered a tutorial-role. The teacher offers guidance and facilitates the PBL process.

As a teaching/learning method, PBL is student-centered and problem-based with learning centered on medical problem areas, health delivery issues, or any other pertinent problem related to a health profession. A teaching-learning method centered on problems fosters the remaining two essential characteristics of PBL which are: there is an integration of the basic and clinical sciences, and there is an emphasis on the development of clinical reasoning skills. A subject-based approach may be effective in delivering a comprehensive knowledge base, but it does not ensure that students will be able to integrate the knowledge acquired from the separate disciplines when faced with a clinical patient problem. In the problem-based approach, students learn the relevance of the basic sciences in its clinical context. They use the knowledge learned from anatomy, physiology, pathology, and biochemistry and integrate this knowledge with newly learned knowledge in the solution of a specific patient problem. The application of the integrated knowledge and the approach to the problem solution fosters the development of the students' clinical reasoning process.

Clinical reasoning process. It is important to understand the function of the clinical reasoning process in view of its significance in the PBL educational process. Barrows and Feltovich (1987) describe the clinical reasoning process of a physician, which they state is often referred to as the hypothetico-deductive reasoning process, to educate medical teachers on its components and thereby ensure the development of an effective and efficient clinical reasoning process in the student. A hypothetico-deductive
reasoning process, is a form of "backward reasoning" during which a physician deduces from initial hypotheses. This is in contrast to "forward reasoning" whereby inferences are made forward from the data (Patel, Groen, and Norman, 1991). In most disciplines, experts tend to engage in "forward reasoning" and novices engage in "backward reasoning." Barrows and Fel托ovich (1987) argue that this is not true of the medical expert physician. After investigating the clinical reasoning process used by physicians in their diagnoses of patients, they found that physicians did engage in hypothesis-oriented inquiry. The complex nature of patient problems compels physicians to generate an initial diagnosis along with several alternatives that would need to be ruled out in order to ensure appropriate patient care.

Patel et al. (1991) suggest that "backward reasoning" may be more useful as a means for learning. The PBL process follows the clinical reasoning process of a physician, which as stated, involves "backward reasoning." Although not documented, the clinical reasoning process of a physician is comparable to the clinical reasoning process of an athletic trainer in practice. The following is a description of the clinical reasoning process of a physician or an athletic trainer as a clinician. The clinical reasoning process is initiated by the presentation of a patient problem containing pertinent information to the diagnosis of the problem, but not all of the necessary information. The clinician will generate multiple hypotheses after initially hearing the problem and will decide upon an inquiry strategy involving additional questions to be asked and the initiation of patient assessment. The clinician will synthesize the history given by the patient and the results obtained in the evaluation and determine several working hypotheses that will be assessed through further examination strategies in order
to conclude with a hypothesis and management plan. Barrows (1986) claims that the PBL approach can elicit this type of reasoning in the student, thus enhancing her clinical reasoning process as a clinician.

In the PBL approach, the process the students follow in the resolution of problems should be in an organized framework similar to the process used by physicians/clinicians in their diagnosis of patient problems. This clinical reasoning process develops over time through teacher guidance. The PBL problem should be approached in a series of steps beginning with the development of multiple hypotheses. The students must then identify a strategy that involves the development of learning objectives that outline knowledge areas they will need to investigate in order to solve the problem. It must be emphasized that students can freely pursue their inquiry into the problem. They may ask questions in any order and may decide to perform part of a physical examination at any time. Barrows (1986) states that a distinct feature of PBL is that students engage in “free inquiry.” After the students have gathered multiple facts concerning the problem, they will partake in individualized self-directed study to investigate learning issues surrounding the problem. The students will utilize this newly learned information that they collected individually and work to synthesize all of the existing information in order to produce a hypothesis and plan for management. This process mimics the clinical reasoning process of clinicians.

Although an important characteristic of PBL is a focus on the development of clinical reasoning skills, it must be noted that the development of problem-solving skills is not the sole objective. The emphasis is on both skill and knowledge acquisition, and not one without the other. Norman (1988) investigated problem-solving skills and PBL
and concluded that the teaching of problem-solving as an independent skill without knowledge acquisition is not the goal of PBL. He supports other PBL advocates in stating that the primary goal of PBL is not to solve the problems, it is to learn new information in the context of a medical problem (Norman 1988). PBL students learn throughout the process of problem solution, not by the solution itself. Another concern is that the student’s efforts will be concentrated on the elements of the physical examination of the patient, resulting in effective clinical skills without appropriate reasoning. With PBL, the problem does not have to be approached in a diagnostic manner in which physical examination skills would be applied; the problem may be approached from multiple perspectives, such as a focus on the pathophysiological mechanisms involved in the problem (Barrows and Tamblyn, 1980). The PBL approach enhances clinical reasoning skills and knowledge acquisition through the process of working through problems.

In sum, the PBL approach is student-centered and problem-based. The knowledge acquired is based on a convergence of the basic and clinical sciences. The process of working through problems facilitates the development of this integrated knowledge base and the effectiveness of the cognitive skills involved in the clinical reasoning process.

Learning Process

There are certain conditions that facilitate the PBL learning process. In reviewing the process of PBL, it is important to identify these facilitating conditions because they are all aspects of the method itself. The following areas have distinctive features that facilitate the PBL process: the learning environment, the role of the faculty tutor, the
problems, the sequence of problem-solving, self-directed learning, and student
assessment. The learning environment is one in which a small group of students engage
in student-centered discussion of problems with the faculty supervisor facilitating the
discussion in the role of a tutor. The problems used are constructed in an intentional way
to invoke and challenge a hypothetico-deductive reasoning process in the students. The
problems are approached sequentially using the clinical reasoning process as a guideline.
After the group’s deliberation over the problem, each member undertakes a period of
self-directed study in response to the learning needs generated by the group. The
individual members then return to the group to re-evaluate the problem and the learning
process ends with an individual and group assessment of the learning process. The
subsequent paragraphs will expound upon each one of these variables through a
description of the PBL process.

Learning environment. Before the PBL process begins, it is important to establish
a learning environment suitable for PBL. PBL works best in a small group format, about
5 to 7 students, with a faculty member as the group tutor. The tutor has the responsibility
of establishing a secure climate that will foster the student’s learning. This climate has to
be one in which the student is able identify him or herself as a part of the group, and one
in which the student feels like his/her contributions to the group are valued (Barrows,
1988). The tutor should also encourage the students to share their voice in an
environment that hears no wrong answers. Initially, the tutor and the students spend time
building rapport and trust among the members of group. Once the group is familiar with
each other, its members must collaborate on the development of educational objectives
for the course. Course or curriculum objectives outlined by the tutor can guide this
discussion of what is to be learned. The tutor should then use the educational objectives created by the group to keep the group on target in their course of learning. Throughout the learning process, the tutor's role in the group is as a guide or as a “metacognitive coach” (Barrows, 1988). As a metacognitive coach, the tutor is encouraging the students to think. Barrows (1985) states “The tutor must guide, not direct; facilitate learning, not dispense information; keep interactions between students alive and the problem-based learning process on track.” (p. 18). The tutor's presence is more significant in the beginning from which it becomes less prevalent as the students become confident with the learning process. A significant part of this learning process is the sequence of clinical problem-solving.

Use of problems in PBL. PBL begins with the students’ recognition of a problem. Problems should be constructed in accordance with course educational objectives. The problems may be presented to the students in several ways such as a case history or vignette, a real-life patient problem, or a simulated patient problem. The features of a problem suited for PBL are the problem presents only a portion of the necessary information, the problem represents an actual real-life patient case, and the problem allows for open-ended free inquiry (Barrows, 1986). Problems of this nature have been created in paper simulation form in medical schools, such as the “Patient Management Problems (PMP),” “Sequential Management Problems (SMP),” and the “Portable Patient Problem Pack (P4)” (Barrows and Tamblyn, 1980, p. 65). Educators can use these published “Problem-Based Learning Modules (PBLM)” or they can construct and publish their own PBLMs through the publishing company at the Southern Illinois University School of Medicine (Barrows, 1985, p. 31). If a simulation patient problem is not
accessible, problems can always be constructed around a real-life medical problem in a given health profession with adherence to the following PBL problem characteristics.

The problems for use in PBL may be constructed in a variety of ways, but they all must fit in the category of an “ill-structured” problem. An ill-structured problem has the following four criteria: “the initial situation lacks all of the information necessary to develop a solution or even to precisely define the nature of the problem;” “there is no single right way to approach the task of unraveling the components of the problem;” “as new information is gathered the problem definition changes, sometimes by being refined, sometimes changing altogether as the new data requires a change in perspective;” and, “students will never be 100% sure they have made the correct selection among solution options because information will still be missing and data and ethical appeals may conflict” (Gallagher, Stepien, Sher and Workman, 1995, p. 138). A problem constructed in this ill-structured fashion will optimize the effects of PBL, enhancing the student’s effective clinical reasoning ability, by allowing the student to engage in “free inquiry.”

The following represents an example of an ill-structured problem in athletic training in the form of a partial case study:

An 18 year-old female ice hockey player was driven into the boards as she attempted to send a puck down the ice. She immediately dropped her glove and stick and skated over to the bench cradling her right arm with her head and neck leaning toward her right shoulder. As she approached the certified athletic trainer, she complained of an intense pain in her right shoulder and stated she felt a “pop.”

This problem presents a minimal amount of information from a real medical case, thus requiring the students to generate multiple hypotheses and proceed with the problem-solving process, all along collecting and synthesizing data. The athletic training student
must rely on his prior knowledge base to develop hypotheses. The problem can be approached from a variety of educational aspects, such as an investigation of the underlying mechanisms of injury or the pathophysiology associated with the injury. The case scenario can also be used to investigate injury evaluation techniques, as well as treatment and management protocols. The direction the problem is pursued in is direct relationship with the educational objectives of the unit. The construction of the problem needs to facilitate this “free inquiry” learning environment.

**Problem-solving process.** After encountering a problem, the students will generate multiple hypotheses concerning the patient problem through “brainstorming” activity and then they will pursue a problem-solving strategy. Drawing four categories on a chalkboard facilitates this process. These categories are placed in columns and are titled: hypotheses (ideas), facts, learning issues, and further tests. The students begin by listing several hypotheses in the solution of the problem based on the information in the patient case and on their existing knowledge base. These hypotheses will guide the next stage of PBL that involves inquiry strategies.

During the inquiry phase, the students collect additional facts of the case through patient history questions, physical examination revealing subjective and objective clinical findings, and information relevant to diagnostic tests, such as a radiographic imagery. Students also speculate on any underlying pathological, anatomical or physiological causes of the specific problem. All of this inquiry is based on the information in the problem and the current knowledge source of the students. This phase of the PBL process may be different depending on the type of problem used in the lesson. When using different simulation problems, the students will uncover answers to their questions.
by using a highlighter on paper problems or a computer for computer simulated problems, or from feedback from a person role-playing a patient problem. All of the pertinent facts are placed in the "facts" category on the chalkboard for organizational purposes.

As the students collect the facts of the case, they continually synthesize all of the new information they have gathered with their existing knowledge base. Once the students have exhausted the facts of the case they may return to the original hypotheses and make any changes by adding or deleting items. This will result in one or two working hypotheses that the students may make decisions upon such as treatment and further tests that would be indicated at this juncture. As the students progress through the PBL process, they continuously note learning issues that arise on the chalkboard. These learning issues are "topics of any sort deemed of potential relevance to this problem and which the group members feel they do not understand as well as they should" (Savery and Duffy, 1995, p. 34). After the students have completed the problem-solving process of the first encounter with the problem, the students agree upon a list of learning issues and they use this list as a guide for the next few days during which they will be engrossed in self-directed study.

Self-directed study. Self-directed study is an important aspect of PBL. The students indicate at the close of the first PBL session the types of resources they will consult. This gives the tutor a good opportunity to point out faculty or other resources that may be helpful. The students engage in self-study and research their learning issues through multiple resources such as library textbooks, journals, the Internet, faculty members, videos, and any other pertinent source. When the students return to the group
and the same problem, they begin by discussing the resources they utilized. In this discussion, students critique these resources according to their quality and usefulness. This facilitates the student's ability to assess resources and determine if they are of a credible nature. After a review of the resources, the students revisit the problem, applying both their previous and newly learned knowledge to the problem-solving process. Once the problem has been revisited, the students must then summarize the entire learning process. In doing this, they identify concepts and principles they learned, they elaborate on this knowledge, and they discuss the knowledge in relevance to the problem at hand. This summary is a very important part of the PBL process and should not be dismissed (Barrows, 1988).

**Assessment in PBL.** In order to assess the PBL process, it is important to terminate each PBL session with an evaluation procedure. Students are asked to evaluate their own performance and the performance of their peers on the following criteria: clinical reasoning skills, knowledge brought to the problem, self-study skills and newly acquired knowledge, and contribution to the group process (Barrows, 1994). The faculty acts as a role model in the assessment process by providing constructive feedback to individuals in the group regarding their performance. This evaluation gives the students a means for assessing their progress. In addition to self and peer evaluations, programs and teachers have constructed evaluative tools specifically for the PBL method, such as the “Structured Oral Self-directed Learning Examination (OSLE).” The OSLE assesses the student's clinical reasoning skills, self-directed learning skills, knowledge and self-assessment ability (Chapman, Westmorland, Norman, Durrell and Hall, 1993). This type of assessment tool is consistent with the objectives of PBL teaching method.
Written examinations used to monitor a student’s progress and factual knowledge base can also be used in PBL assessment; however, a written examination typically given in the traditional approach consisting of multiple choice questions is not effective by itself in evaluating the students of PBL (Barrows, 1994). Multiple choice questions cannot be constructed to assess certain PBL objectives such as self-directed learning.

Maastricht University developed a written examination called the “progress test” that they and several other medical schools administer at the end of each year to the students in their PBL curriculums (Verwijnen, Vleuten, and Imbros, 1990). The “progress test” consists of multiple choice questions that encompass the breadth of basic science and clinical science information expected of a senior graduating medical student. Even though the senior students should be the only students capable of passing this exam, it is given early on in the academic program and is used yearly to objectively monitor student progress. Objective measures such as this are crucial for both the students and faculty so that student performance and program effectiveness can be monitored.

The preceding discussion described the PBL learning process, including facilitating conditions necessary for the success of its implementation. The PBL process is student-centered, guided by a tutor, and follows a problem-solving sequence that mimics the clinical reasoning process of a physician/clinician. The PBL problems invoke multiple hypotheses which lead students in multiple directions of inquiry. Students learn new knowledge in the context of the given problem through self-directed study. The PBL process is not complete until the students summarize the information they have learned and perform a self and peer evaluation on their learning process. Additional assessment strategies may be employed as well. This presentation depicts the structure of
PBL in what some would identify as its “pure” form (Scheiman and Whittaker, 1990, p.113). PBL was established in its pure form at McMaster University (1969), and has since branched off into a variety of PBL formats. Barrows (1986) states that PBL should be treated as a genus for which there are many species and subspecies.

Variations in Method

Barrows (1986) indicates that PBL does not refer to one educational method. In fact, there have been a number of alterations of the original PBL method, that he decided to change the name PBL to “practice-based learning” to specify the practice of PBL in medicine (Barrows, 1994). As noted, there are several varieties of the PBL approach, and they can be classified according to the teaching-learning method employed and the problem types used. The teaching-learning method of a PBL approach is problem-based and it can vary by being either teacher-centered or student-centered. The problem types used in PBL can also vary. These problems can be case vignettes or case histories, patient problem simulations, or real patients. The case histories may offer complete patient information or they may depict only a portion of the information. The important feature of the PBL problems is that they are based on real-life cases. Sibley (1989) emphasized that the most powerful problems for learning are based on real-life patient cases.

Barrows (1986) proposes a taxonomy of PBL methods to highlight differences among methods and to facilitate a teacher’s choice of an appropriate PBL method for their students. The type of PBL method used depends on the educational objectives the teacher has selected. The educational objectives that can be met with PBL are: the structuring of knowledge for use in its clinical context, the development of an effective
clinical reasoning process, the development of effective self-directed learning skills, and an increased motivation to learn. Each method of PBL has the potential to attain the PBL educational goals. Barrows (1986) makes an analytical argument that the PBL methods differ in the extent to which they meet each PBL objective. For example, a PBL method that is primarily student-centered and is based on simulated problems will be more effective at fostering the student's clinical reasoning skills and self-directed learning skills than a method that is teacher-directed and presents a complete case history. Barrows (1986) proposes this taxonomy as a guideline indicating that several variables such as teaching skill may play a major role in the quality of each method. In this case, a motivating teacher can make a difference in a PBL method that is considered to be less effective at fostering motivation than other PBL method.

Barrows describes six PBL methods: lecture-based cases, case-based lectures, case method, modified case-based, problem-based, and closed-loop problem-based. He then uses a rating scale of 0-5 as a comparative measure among PBL methods to rate the ability of each method to address PBL objectives. Each method will be examined briefly and their ability to address the proposed PBL educational objectives will be discussed.

The PBL method, lecture-based case, utilizes cases to emphasize key learning objectives that were presented in a lecture. Students analyze a complete case following a given lecture. This method highlights teacher-directed learning and presents a complete case history. Cased-based lectures differ from lecture-based cases by the relationship of the complete case given and the lecture. The case-based lecture method presents a complete case before a given lecture. The information in the case will be represented in the subsequent lecture. Typically, both lecture-based cases and case-based address all of
the PBL educational objectives (ratings of 1’s and 2’s) except for the development of self-directed learning skills (rating of 0).

The case method presents a complete case history to the students and is marked by both teacher-directed and student-directed discussion following the study of the case. This method is motivating to the students and structures knowledge in a clinical context. It encourages self-directed study, but is limited in developing the student’s clinical reasoning ability due to the design of the problem. Complete case studies synthesize all of the patient information in an organized format. This deprives the students of the opportunity to collect information pertinent to the case and to synthesize it on their own. The case method addresses all of the PBL educational objectives (ratings of 3’s and 4’s).

Another PBL method, the modified case-based method utilizes partial cases (do not contain all of the necessary information), and partial problem simulations such as the PMP and SMP in a student-directed learning environment. This method is effective in addressing all of the educational objectives (ratings of 3’s, 4’s, and 5). Barrows (1986) feels that there are better methods than the modified case-based to facilitate the clinical reasoning process and self-directed learning skills of students. He goes on to say that the typical PMPs and SMPs have an imposed structure and restrict free inquiry of the problem thereby limiting the clinical reasoning associated with a clinical patient problem.

The last two variations in PBL methods are consistent with Barrows’ definition of PBL. One method is the problem-based method. This PBL method utilizes complete problem simulations that allow free inquiry. The students can take the problem in any direction as they follow through the stages of problem-solving. This method is completely student-directed and facilitated by a faculty tutor. The last PBL approach
examined and the one considered by Barrows to be effective in addressing all PBL educational objectives successfully is the closed-loop problem-based method. This method is an extension of the problem-based method. The closed-loop method involves a revisiting of the problem after a period of self-directed study. This allows the students to evaluate resources used, reexamine the problem with new information, and evaluate their performance throughout the learning process. The closed-loop method furthers clinical reasoning and acquisition of knowledge because students have the opportunity to elaborate on and use new knowledge in the solution of the same problem (ratings of 5's). Again all of these methods are types of PBL methods, but they can differ in their ability to achieve PBL educational goals.

Outcomes

PBL has the potential to address the following key educational objectives: develop clinical reasoning, structure knowledge in clinical contexts, develop self-directed learning skills, and motivate learning. These key objectives are the measurable outcomes used as variables in the assessment of the effectiveness of PBL in comparison to traditional methods (Thomas, 1997). A series of meta-analyses and literature reviews in medical and allied health education have consistently identified these areas throughout the research as well as research addressing implementation issues such as cost and faculty time. For the purpose of this study, the review will focus on the research pertaining to the educational outcomes stated above.

This review will begin by reporting the findings of the meta-analyses performed on the research literature comparing PBL curricula with traditional curricula and then will delve into individual studies on the addressed measurable outcomes: clinical reasoning,
knowledge, self-directed learning, and motivation. It is important to note that the comparisons made between PBL and traditional educational approaches have been made between courses, parallel tracks within the same school, and at a curricular level comparing medical school programs. Vernon and Blake (1993) performed a meta-analysis on the PBL literature. They reported that student attitudes and opinions of PBL were favorable. They surmised that PBL students performed better on clinical evaluations and there were no significant differences between the two groups on factual examinations. However, it was reported that the traditional students did perform better on Part I of the National Board Medical Examination (NBME). This examination is presented in written, multiple-choice questions.

Albanese and Mitchell (1993) also performed a meta-analysis on the PBL literature and reported the strengths and weaknesses of PBL. One strength of PBL reported by Albanese and Mitchell is that faculty and students enjoy PBL more than traditional methods. Another strength is students of PBL perform equally and sometimes favorably on clinical and faculty examinations. The weaknesses of PBL indicated poor performance of PBL students on basic science examinations in comparison with traditional students, and concern regarding implementation issues. These two meta-analyses present the general findings of the literature. The succeeding paragraphs will identify the key studies that investigated the proposed outcomes of PBL.

**Clinical reasoning.** The clinical reasoning process, commonly described as a problem-solving process, is a cognitive process used by physicians and clinicians to evaluate and manage medical problems (Barrows and Tamblyn, 1980). Barrows and Feltovich (1987) examined the clinical reasoning process of expert physicians and
concluded that physicians reasoned in a hypothetico-deductive fashion. The hypothetico-deductive reasoning process, a form of "backward reasoning," is "characterized by the generation of multiple hypotheses followed by a problem-oriented inquiry to elaborate the problem and choose the correct hypotheses" (Barrows and Feltovich, 1987, p.88). In a study examining the clinical reasoning process of students from a PBL approach and from a traditional approach, Patel et al. (1991) revealed that PBL students have a hypothetico-deductive reasoning process, similar to a medical expert and the traditional students had a "forward-directed" reasoning process. They also found that the PBL students were likely to elaborate on clinical information, although sometime with error, which was not consistent with the traditional students. Another study comparing clinical competence of PBL and traditional students produced inconclusive results (Schmidt, Dauphinee, and Patel 1987). The difficulty in assessing an individual's problem-solving process causes limitations in studies trying to compare the effectiveness of one educational method over another in its ability to foster problem-solving.

**Knowledge.** Several studies have analyzed the academic achievement of students from the PBL and the traditional approach. Variables such as basic science knowledge acquisition, clinical competence, and knowledge retention have been investigated. Before pursuing this investigation, it is important to delve deeper into the rationale behind PBL's effectiveness as an instructional method as outlined in the cognitive psychology literature. Schmidt (1983) outlines the three principles in cognitive psychology involved in the processing of new information: activation of prior knowledge, encoding specificity, and elaboration of knowledge. Research in cognitive psychology reveals that the prior knowledge one has about a subject determines what can
be learned about that subject (Norman and Schmidt, 1992). The ability to process new information and understand is dependent on activating prior knowledge. The current theory views “coming-to-understand” as an interactive process where the prior knowledge (or memory) of the learner interacts with the new information (Patel, 1990). In this respect, remembering and understanding are not independent of each other (Patel, 1990). A research study supporting this theory found that medical students with a greater content background demonstrated an understanding of patient cases by transforming case information and making inferences, and medical students with a more fundamental background would simply recall information about the case and not make any inferences (Patel, 1990).

Schmidt (1983) argues that PBL can meet the requirement of activation of prior knowledge if the problems used are structured according to the following criteria: the problem should require further explanation, the problem must lead to problem-solving activity, the problem needs to be concrete, and the problem should have a degree of complexity, but be adapted to student’s prior knowledge level (they need to recognize there is a problem and it cannot be too complex). The construction of an appropriate problem and the process of problem-solving in PBL make it an effective instructional strategy to activate prior knowledge. The process of problem-solving is important to mention because the PBL process begins with a clinical problem that the student must work to solve using only his prior knowledge base.

The second condition that facilitates learning noted by Schmidt (1983) is encoding specificity. The notion of encoding specificity is that information learned in a context that will resemble the same context of its future use will foster the retrieval of
that information in the future. Or in other words, “the closer the resemblance between
the situation in which something is learned and the situation in which it is applied, the
better the performance” (Schmidt, 1989, p.106). Norman and Schmidt (1992) offer a
simple example to illustrate this phenomenon: a person may have difficulty remembering
the name of a colleague when they run into that person at a food store; the knowledge of
the colleague’s name is encoded with the workplace. PBL meets this condition of
learning through the use of problems that are similar to the clinical problems that students
will be exposed to in their professional future. Problems for use in PBL are suggested to
be real-life clinical problem, thus resembling the problems students will experience in
their future career.

The last condition that facilitates the processing of new information is the
elaboration of knowledge. Psychologists have recently found that “information is better
understood, processed and retrieved if students have an opportunity to elaborate on that
information” (Schmidt, 1989, p. 106). There are two elaboration processes that occur in
the PBL environment. The first is activated after initiation of a problem and is facilitated
through student discussion. When students first encounter a problem, they apply their
existing knowledge and discuss these concepts and principles that apply among the
group. The second process that involves elaboration is when the students return to a
problem after a period of self-directed study. They bring new information, critique this
information and apply it to the clinical problem. In these instances, PBL fosters the
elaboration of knowledge. The structure of PBL appears to provide a environment
conducive for learning and if these psychological theories are accurate, PBL should
enhance the student’s long-term recall of information in the clinical setting. The
effectiveness of PBL in long-term recall of information has been supported but warrants further investigation (Norman and Schmidt, 1992).

As mentioned, there have been several studies that compared academic variables such as knowledge acquisition and recall between PBL and traditional methods. One such study (Eisenstaedt, Barry, & Glanz 1990) compared scores on a multiple-choice examination between students in a traditional lecture class and students in a PBL tutorial. The exam was given at the end of the course and again 2 years later. The PBL students scored lower on the first exam when compared to their traditional counterparts; however, on the exam taken 2 years later, the scores were the same, indicating that the PBL students had better overall retention. The authors were not surprised that PBL students scored lower than the traditional on the first exam because the exam was designed to assess recall of specific facts and did not require any elaboration or interpretation of the material.

Several studies have used basic and clinical science exam scores as a basis for educational method comparison. One study (Kaufman, Mennin, Waterman, Duban, Hansbarger, Silverblatt, Obenshain, Kantrowitz, Becker, Samet, & Wiese, 1989), compared the students from a traditional track with the students from a PBL track at the same school on their outcome on the NBME Part I (basic sciences) and the NBME Part II (clinical sciences). They reported that students of the PBL track scored lower than traditional students on Part I and higher than traditional students on Part II. PBL students also received superior evaluations on their clinical rotations. These findings if compared with the results of Eisenstaedt et al. indicate PBL students do not fair as well on written exams, but in this case, they perform better on an exam assessing their clinical
knowledge. This supports the claim that PBL fosters the structuring of knowledge in a clinical context.

Other studies using examination scores as an evaluative method found little or no differences between PBL and traditional curricula. Baca, Mennin, Kaufman, and Moore-West (1990) compared the academic performance of students from a PBL track and students from a traditional track at the same school. The academic performance was assessed by performance on three areas: NBME Part I and II, grades on clinical rotation, and academic progress over a 4 year time period. They found no difference in academic performance between both groups. Verwijnen, Vleuten, and Imbros (1990) compared the PBL program at Maastricht Medical School with three other medical schools that housed traditional programs. They used a test known as the “Progress Test”. This test is a traditional written exam that evaluates the knowledge expected of a medical school graduate. The Progress Test can be used to compare competency between and within medical schools. The Progress Test was given to students several times over a three-year period and the test results revealed no significant difference in knowledge between the PBL program at Maastricht and the traditional programs at the other medical schools. An important finding demonstrated in these two studies is PBL is as effective as traditional teaching methods in knowledge acquisition.

The preceding research investigated comparisons of curriculums or tracks between PBL and traditional approaches and found no difference. The following two studies examined differences between PBL and traditional methods by comparing performance according to class year. Login, Ransil, Meyer, Truong, Donoff, and McArdle (1997) compared dental students of traditional instruction and PBL instruction
with an oral examination designed to assess the student's organization and thoroughness, diagnosis, primary treatment plan, alternate treatment plan, medical and science knowledge and dental knowledge. The exam was given at the time of graduation over a 4 year period as the program transitioned from lecture-based instruction (class of 1991) to PBL instruction (class of 1994). The results revealed a significant difference between the class of 1991 and class of 1994 in the area of medical and science knowledge, with the PBL students performing better. There were no other significant differences found.

Martenson et al. (1992) transformed a medical curriculum at the University of Tromso, Norway, from a traditional curriculum to a PBL format. To assess the effectiveness of PBL, they compared the scores on a knowledge test from the traditional year with the scores from the PBL year. They reported no differences in knowledge between the two groups, yet did find that student attitudes were more favorable to the PBL format. Again, these studies demonstrate that PBL may not result in higher scores in knowledge acquisition when compared to traditional methods, but what is as important is scores are not lower.

**Self-directed learning.** Another educational objective that is claimed to be addressed by PBL is the development of self-directed learning skills. There are two key studies that use self-directed learning skills as a variable outcome in the comparison of PBL students with traditional students. Barrows and Tamblyn (1976) compared two groups, a PBL group and a control group, using simulated patient problems. A multiple-choice test was developed and given at the end of a self-study period and the test scores were used to make comparisons between groups. The PBL group scored better than the control group, but this difference was not statistically significant. The other study by
Shin, Haynes and Johnston (1993) evaluated both traditional and PBL post-graduate students on their life-long learning skills through a questionnaire developed to assess current knowledge regarding hypertension. The results revealed that PBL students were more up-to-date on current information and protocols, suggesting that they have developed effective self-directed learning skills. The latter study demonstrates that the PBL graduates possess the self-learning skills that will promote life-long learning in medicine.

**Motivation.** Barrows and Tamblyn (1980) state that student-directed learning fosters an internal motivation in the student to learn. The student-centered approach and self-directed independent study sessions require students to be active participants in their learning. Barrows and Tamblyn suggest that this personal interest in growth and learning increases the student motivation to learn. A few studies have attempted to evaluate motivation by comparing the scope of educational objectives proposed by students compared to the scope outlined by expert tutors, and found that students selected fewer objectives (Thomas, 1997). These findings do not support the claim that PBL increases motivation to learn. Although PBL advocates claim PBL increase the student's motivation to learn, there is no direct evidence to indicate this. The proceeding discussion reveals that students of PBL have favorable opinions and attitudes toward PBL. The student’s favorable attitudes toward PBL may relate to an increase in their motivation to learn.

As this literature review has indicated, the differences between the PBL and the traditional educational approach are null or marginal. The methods used in the preceding studies were primarily objective, utilizing measures such as examination scores.
According to these studies, PBL is as effective as traditional methods. With PBL being as effective, it becomes a matter of preference for faculty and students. The following studies investigate student and faculty attitudes and opinions on PBL and its effectiveness. These studies are highlighted because they present an alternative method for PBL evaluation, and a method that will be consistent with the one chosen for this research project.

Bernstein, Tipping, Bercovitz, and Skinner (1995) surveyed both student and faculty attitudes and opinions about PBL after introducing them to a PBL course. Both initial reactions and post-reactions were assessed with a questionnaire in order to determine if there was any shift in attitude over the semester. The results revealed that students developed a more favorable attitude toward PBL at the end of the semester and found it more stimulating and enjoyable than traditional methods. Students did feel that traditional methods were better for knowledge acquisition. Faculty attitudes were consistent with student attitudes about PBL, and it is worth noting that faculty were very apprehensive at the start due to a perceived lack of structure with the PBL format.

Vernon (1995) researched deeper into faculty attitudes and opinions in order to obtain a faculty evaluation of the effectiveness of PBL as a method in comparison to traditional methods. The questionnaires were sent to PBL faculty and focused on nine evaluative measures: student interest and enthusiasm, factual knowledge of basic sciences, understanding general principles, faculty interest and enthusiasm overall, own personal satisfaction, efficiency of learning, student reasoning ability, preparation for clinical rotations, and overall value to students. The results demonstrated that faculty attitudes and opinions of seven of the nine criteria were more positive toward PBL than
traditional methods, with an emphasis on student and faculty interest and enthusiasm, personal satisfaction, and the student’s clinical reasoning and preparedness for clinical rotations. Traditional methods were favored for basic science knowledge acquisition. Vernon and Hosokawa (1996) expanded this study to include all faculty associated with PBL, including non-participants in the PBL curriculum and participants who were not tutors. The non-participants did not indicate a difference between the traditional curriculum and the new PBL curriculum. Participants favored the PBL curriculum, and both groups found PBL to be more effective in regards to student interest and enthusiasm, and student clinical reasoning and clinical preparedness.

In sum, PBL research has highlighted many strengths and weaknesses of PBL. The strengths of PBL in comparison to traditional methods are: enhanced clinical reasoning skills, better self-directed learning skills, knowledge base that is better retained, retrieved and applied, increase in students’ motivation to learn, and students and faculty find it more enjoyable (Saarinen-Rahiika and Binkley, 1998; Scheiman and Whittaker, 1990). The weaknesses associated with PBL, again in comparison to the traditional methods, are: poor performance on basic science examination, as well as problems with implementation issues not addressed in this review but include an increase in cost, increase in faculty time, an initial increase in teacher preparation time, difficulty in evaluating student performance, and an initial dissatisfaction by students due to workload increase.

The literature measuring the outcomes of the PBL educational approach in comparison to the traditional approach is very inconclusive. The findings indicate marginal differences between PBL and traditional methods. However, there are a
significant number of research studies on PBL that depict its general strengths and weaknesses, thus offering insight into its potential outcomes. It can be concluded that PBL is enjoyable and satisfying for both faculty and students, which is a reason that leads many to consider its implementation.

Summary

This literature review has presented a comprehensive description of the PBL educational approach. According to Barrows' definition, PBL is a small group, student-centered approach to learning that is facilitated by a tutor. The group encounters an ill-structured problem in a related field and applies the clinical reasoning process to learn through its possible solution. The clinical reasoning process applied is a hypothetico-deductive reasoning strategy that is used by expert physicians and clinicians in their evaluations of patient problems. An important component of PBL is the student's engagement in self-directed study after an initial investigation of a problem. These are the key features of PBL, but they can be implemented in a variety of ways. There are several variations of the PBL method including lecture-case based, case-based lecture, case-based, modified case-based, problem-based, and closed-loop problem-based. These PBL methods claim to address the following outcomes: structure knowledge in clinical context, develop clinical reasoning skills, develop self-directed learning skills, and motivate learning. The problem-based and closed-loop problem-based methods are suggested by Barrows to be the most effective in attaining these outcomes.

The general findings of the research indicate the PBL educational approach is equally effective as the traditional approach. There were no or marginal differences found between these two approaches regarding the following variables: basic science...
examinations, clinical science examinations, clinical rotation evaluations, self-directed learning skills, and motivation assessment. An evaluation of the clinical reasoning process of both PBL and traditional students revealed PBL students engaged in backward reasoning, similar to an expert physician; and, traditional students engaged in forward reasoning. Research on student and faculty attitudes and opinions on PBL indicate PBL is more enjoyable and favorable. Both faculty and student perceptions of PBL revealed an increase in interest, and better performance on clinical evaluations. This literature review demonstrates inconclusive findings on the effectiveness of PBL as a method and identifies a lack of research on PBL in athletic training education. This gap in athletic training educational research drives the purpose of the ensuing investigation as well as a need for contribution to the questionable findings in the medical and allied health education literature on PBL.
CHAPTER III

METHODOLOGY

The purpose of this study is to identify the prevalence of Problem-Based Learning in athletic training education and to evaluate the outcomes of PBL according to the opinions and attitudes of educators. More specifically, the following areas will be addressed:

1. The frequency with which CAAHEP accredited athletic training educational program educators currently employ PBL, and the types of PBL methods they use;
2. The attitudes and opinions of the PBL faculty on its effectiveness in achieving educational goals;
3. A description of other methods that are implemented in the education of athletic training students;
4. The attitudes and opinions of faculty applying methods other than PBL on the effectiveness of these methods in attaining educational goals; and,
5. The relationship, if any, between demographic features, such as teaching background, typical class size, years of teaching, highest degree held, and percent of time dedicated to classroom instruction, and particular types of teaching methods employed.

Population and Sample

The subjects for this study were 101 CAAHEP accredited athletic training
undergraduate educational program educators. Currently, there are athletic training educators teaching in two different arenas: the curriculum setting, and the internship setting. The educators in the curriculum setting were chosen for two reasons. One reason is the internship educational route will be abandoned by the year 2004. The other reason is the educators in a curriculum educational route are required by the accrediting agency CAAHEP to offer a comprehensive educational structure to the students, encompassing a broad range of educational objectives. Coverage of these educational objectives is attained through many athletic training courses involving formal instruction. The internship route is not subject to this educational framework, and does not need to cover the same number of athletic training courses through formal instruction. The instructional strategies employed by athletic training educators in a CAAHEP accredited curriculum are applicable to the present and future structure of athletic training education.

The subjects were chosen by a simple random selection procedure. An alphabetical list by state of 75 undergraduate CAAHEP accredited athletic training educational programs was downloaded off of the National Athletic Trainer’s Association Educational Council Web page (www.cewl.com) in September 1998. Each program was given a number and 37 programs were chosen using a random numbers table. The program directors for each CAAHEP program selected were notified via e-mail about the study and were asked to respond with a list of teaching faculty in their educational program. It was necessary to have a list of the individual names of all athletic training teaching faculty in each program in order to keep track of the survey returns. The program directors from 24 institutions responded with teaching faculty names, which comprised a working list of 102 athletic training educational faculty. One of the
educators was later found not to be a teacher, so this person was removed from the list, leaving a total of 101 participants. The other 13 athletic training program directors that were contacted did not respond with names of their faculty. They were contacted on several occasions via e-mail and phone messages, but failed to respond.

Instrumentation

The instrument used for this study was a survey (Appendix A) comprised of 10 demographic items, 20 closed-response items and 3 open-response items. The survey is divided into three sections: background information, instructional methods, and educational outcomes. The structure of this survey was adopted from a previous study on PBL faculty opinions and attitudes performed by Vernon (1995). The creation of the survey involved a series of revisions and a pilot study. Initially, the instrument was drafted and distributed to six colleagues representing a variety of disciplines in higher education. After a number of revisions, the survey was then sent to 14 athletic training educators as a pilot study. The educators were asked to complete the survey and critique it on the following criteria: clarity, completeness, bias, and time to complete, as well as to make any additional comments. The results of this pilot warranted minor adjustments to the survey to prepare it for distribution to the population sample.

The genesis of survey items came from the review of literature. The first section of the survey contains questions designed to ascertain the educational background and experience of athletic training educators, as well as the amount of time they currently allot to their instructional practice. These demographic items may relate to the type of instructional methods employed by the educators. The second section, developed from the PBL literature, presents survey items that highlight specific teaching techniques.
These items are based on the categories of teaching-learning methods suggested by Barrows and Tamblyn (1980). Teaching-learning methods fall into two categories: they are either teacher-centered and/or student centered; or, they are subject-based and/or problem-based. PBL methods are certainly problem-based, but they may be either teacher-centered or student-centered.

Barrows (1986) further describes PBL teaching-learning methods by the type of problem used, the presentation of the problem, and the ratio of teacher-directed to student-centered learning. According to Barrows (1986), the type of PBL method that is effective in addressing all of the PBL educational objectives is typically student-centered and initiates learning with an ill-structured problem that is based on a real patient case. An ill-structured problem has these characteristics: it lacks all of the information necessary to develop a solution; it can be approached from multiple angles; it takes new form throughout its solution; and, it does not present a clear conclusion (Gallagher, Stepien, Sher and Workman, 1995). The ill-structured problems may be presented to the students in several ways such as a case history or vignette, a real-life patient problem, or a simulated patient problem. The survey items highlight ill-structured problems as real-life partial case histories and textbook generated partial cases histories. Other surveys items present complete case histories, both real-life and textbook, as well because they are often used in PBL.

The section of survey items dedicated to teaching techniques was conceptually constructed using the six different PBL methods outlined by Barrows (1986), which highlight the aforementioned criteria. The different types of PBL methods are lecture-based cases, case-based lectures, case method, modified case method, problem-based,
and closed-loop problem-based. The following discussion will identify each PBL method as it is represented in the survey items (Table 1).

<table>
<thead>
<tr>
<th>PBL Method</th>
<th>Description</th>
<th>Teaching/Learning Method</th>
<th>Survey Item #s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture-based case</td>
<td>A case history is assigned after a lecture to highlight material</td>
<td>Teacher-directed; Problem-based</td>
<td>#14</td>
</tr>
<tr>
<td>Case-based lecture</td>
<td>Case histories are assigned prior to a lecture</td>
<td>Teacher-directed; Problem-based</td>
<td>#13</td>
</tr>
<tr>
<td>Case method</td>
<td>Study and discussion of complete case histories</td>
<td>Teacher-directed/student-centered; Problem-based</td>
<td>#17, #19, and #21</td>
</tr>
<tr>
<td>Modified case-based</td>
<td>Group problem-solving of incomplete cases or simulation problems.</td>
<td>Student-centered/teacher-directed; Problem-based</td>
<td>#17, #18, #20, and #22</td>
</tr>
<tr>
<td>Problem-based</td>
<td>Group problem-solving of free-inquiry patient simulation problems.</td>
<td>Student-centered; Problem-based</td>
<td>#17, #18, #20, and #22</td>
</tr>
<tr>
<td>Closed-loop problem-based</td>
<td>Same as problem-based except the problem is revisited and the process is evaluated.</td>
<td>Student-centered; Problem-based</td>
<td>#17, #18, #20, and #22</td>
</tr>
</tbody>
</table>

The lecture-based case method and the case-based lecture method utilize complete cases histories to emphasize key learning objectives presented in lecture. Survey item numbers 13 and 14 represent these types of the PBL method. Another PBL method, the case method, also utilizes complete case histories, but is marked by both teacher-directed and student-directed discussion following the study of the case. This method is highlighted in survey item numbers 17, 19 and 21.

The above methods are primarily teacher-directed and use complete case histories. The PBL methods that are student-centered and utilize ill-structured problems...
as a basis for learning are the modified case-based method, the problem-based method, and the closed-loop problem-based method. These PBL methods utilize incomplete or partial case histories, or simulated patient problems in a student-centered learning environment. The modified case-based, problem-based, and closed-loop problem-based methods are highlighted in survey item numbers 17, 18, 20, and 22. An important aspect of all of the PBL methods mentioned is they incorporate a self-directed study component in which students are required to utilize multiple resources in the investigation of problems. This component is highlighted as survey item number 22.

In sum, the survey items in section two present teaching techniques that are either teacher-directed or student-centered, and they highlight several of the characteristics of PBL methods. Items #13 and #14, and #17 to #22 represent distinctive characteristics of the different types of PBL, with items #17, #18, #20, and #22 representing PBL in its pure form. The survey items #11, #12, #15 and #16 depict the traditional teaching methods, which utilizes a lecture to deliver knowledge. Participants were asked to respond to each of these items indicating the use of each method during a typical week of teaching. Responses were rated on a 1-6 Likert-scale, with 1 indicating “never” (“I never use this technique”) and 6 indicating “always” (“I always use this technique”). Participants were also asked to identify any other method that they employ that was not represented in the survey items, and to apply the same Likert rating.

The last section of the survey is designed to elicit an evaluation from the participants concerning the outcomes of their indicated instructional methods. These outcomes were derived from the survey employed by Vernon (1995), and from the educational objectives proposed by Barrows (1986), which claim PBL will structure
knowledge for use in clinical contexts, develop an effective clinical reasoning process, develop self-directed learning skills, and increase the student’s motivation to learn. The following list of outcomes was developed from a combination of the above sources in relation to athletic training education:

- students’ high interest and enthusiasm
- students’ knowledge of anatomy, physiology and kinesiology
- students’ understanding and ability to apply athletic training concepts to the clinical experience
- students’ self-directed learning
- students’ effective clinical reasoning ability
- students’ preparation for the certification exam
- teacher’s personal satisfaction
- overall value to the students

Again, participants responded to these outcomes on a 1-6 Likert-type scale, with 1 indicating “strongly disagree” (“I strongly disagree that my educational methods meet this outcome”) and 6 indicating “strongly agree” (“I strongly agree that my educational methods meet this outcome”). In addition, participants were requested to make any explanations or qualifications concerning their responses to the outcome items.

**Data Collection Procedure**

A cover letter (Appendix B) and a copy of the survey were mailed to the 101 participants with an enclosed self-addressed stamped envelope for return of the survey. Each survey was coded with a number that corresponded to each name on the mailing list for the purpose of tracking the return of surveys and pursuing appropriate follow-ups.
The directions for completion of the survey were noted in the cover letter and at the beginning of each section on the survey. The cover letter indicated a return date allotting two weeks for completion and return. After that two week period, a follow-up letter (Appendix C) with another copy of the survey (with the same code) and an enclosed self-addressed stamped envelope was mailed to non-respondents in an attempt to accrue more returns. These letters were sent a week before the end of the Fall semester, and follow-up phone calls and e-mails were pursued near the end of January to encourage return of the surveys. Return dates of surveys were recorded. Surveys received after the first follow-up were identified as late respondents. Sixty-nine responded promptly and 14 were late. A chi-square analysis across all items revealed no significant difference between prompt and late respondents. Therefore, all subsequent analyses included the data from all respondents. Out of the 101 athletic training educators surveyed, 83 responded. This yields a response rate of 82%.

Data Analysis

The statistical analysis performed on the data collected from the surveys was conducted using the Statistical Package for the Social Sciences (SPSS, 1988) computer program. The data obtained from the surveys was organized into three categories, consistent with the three sections of the survey: demographic information, teaching methods, and outcomes. The frequencies, means, and standard deviations were calculated for all of the demographic items, teaching method items, and outcome items for all respondents. Non-responses were coded as missing values and were not used in the calculations. A reliability analysis was performed on the teaching method items (alpha = .83) and the outcome items (alpha = .89) to ascertain the internal consistency of
the survey instrument. This was reported using Cronbach’s alpha coefficient. The teaching method category was further organized to reflect different teaching methods.

**Teaching Method Subscales.**

In order to identify teachers, who used PBL methods, the method subscale needed to be divided into questions that reflected PBL methods or what has been defined as traditional methods. The PBL subscale and the non-PBL (traditional) subscale were initially defined conceptually as previously described. High scores on items #13, #14, and #17 to #22 suggested the use of PBL methods. The other survey items, #11, #12, and #15 were included to provide responses for teachers who did not use PBL methods. These non-PBL survey items highlighted traditional methods such as the teacher-directed lecture.

Factor analysis was used to confirm the conceptual grouping of the teaching method items into either PBL or non-PBL teaching methods. A principal components analysis with varimax rotation was used to reduce the 10 X 10 intercorrelation matrix of teaching method items (Table 2) to three factors: PBL, non-PBL, and other. The results of this factor analysis are presented in Table 3. The PBL factor was consistent with the

<table>
<thead>
<tr>
<th>Variable</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Intercorrelation Matrix for Teaching Method Items

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Table 3: Factor Analysis of Teaching Method Items

<table>
<thead>
<tr>
<th>Variable (item #)</th>
<th>Factor I</th>
<th>Factor II</th>
<th>Factor III</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 teacher-directed lecture</td>
<td>-.41</td>
<td>.52</td>
<td>-.01</td>
</tr>
<tr>
<td>12 teacher-directed question</td>
<td>.11</td>
<td>.85</td>
<td>.09</td>
</tr>
<tr>
<td>13 case prior to teacher-dir lecture</td>
<td>.72</td>
<td>.07</td>
<td>.17</td>
</tr>
<tr>
<td>14 case after teacher-dir lecture</td>
<td>.62</td>
<td>.00</td>
<td>.49</td>
</tr>
<tr>
<td>15 teacher-dir. moderates discussion</td>
<td>.51</td>
<td>.46</td>
<td>-.53</td>
</tr>
<tr>
<td>16 teacher-dir demo of strategy</td>
<td>.42</td>
<td>.60</td>
<td>.20</td>
</tr>
<tr>
<td>17 stud.-ctred; use case studies</td>
<td>.76</td>
<td>.12</td>
<td>.04</td>
</tr>
<tr>
<td>18 stud.-ctred; use partial text cases</td>
<td>.82</td>
<td>-.02</td>
<td>-.04</td>
</tr>
<tr>
<td>19 stud.-ctred; use complete text cases</td>
<td>.79</td>
<td>.03</td>
<td>.21</td>
</tr>
<tr>
<td>20 stud.-ctred; use partial real cases</td>
<td>.79</td>
<td>.11</td>
<td>-.10</td>
</tr>
<tr>
<td>21 stud.-ctred; use complete real cases</td>
<td>.59</td>
<td>.25</td>
<td>.09</td>
</tr>
<tr>
<td>22 self-study assignments</td>
<td>.18</td>
<td>.40</td>
<td>.71</td>
</tr>
</tbody>
</table>

conceptual definition of PBL except for two items. The items that loaded on the PBL factor are items #13-#15, and items #17-#21. Although item #22 was conceptually defined in the PBL group, it did not load on the PBL factor. Item #22 was the only item loaded on the “other” factor. This item highlighted self-directed study techniques that could be used in conjunction with all methods. Item #15 did load on the PBL factor; however, conceptually it was grouped with traditional teaching methods, not PBL methods. Items #11, #12 and #16 loaded on the non-PBL factor revealing consistent results with the conceptual definition of the traditional lecture-style method.

After the factor analysis, a second reliability analysis was performed on items identified in the PBL factor: #13-#15 and #17-#21. This analysis reported strong reliability (alpha = .86) among those items. The item analysis revealed, however, that when item #15 was removed from the subscale, there was an increase in alpha level (.867). Given that the subscale showed strong reliability with item number 15 deleted and the conceptual rationale for not including it, the PBL scale was defined as items #13-#14, and #17-#21, and these items were used to identify the degree to which teachers...
used PBL during a typical week.

**Identifying PBL and Non-PBL Respondents**

Respondents were placed into a PBL group or a non-PBL group. Participants who selected above the mean on the PBL subscale items, #13-#14 and #17-#21, were placed in the PBL group, and all other participants were placed in the non-PBL group. The mean for each PBL item was selected from an analysis of all cases. If a respondent ranked above the mean on items #13 or #14, item #17, items #18 or #19, and item #20 or #21, she/he was considered to be implementing PBL methods. The item numbers presenting a choice (e.g., #13 or #14) depict similar methods except for a slight variation; thus, it was reasonable to suggest that if they are using one or the other, they are using PBL.

Responses of the PBL and non-PBL groups across demographic and outcome items were compared first using chi-squares. The frequencies, means, and standard deviations were calculated for the demographic and outcome items for each group, PBL and non-PBL. The mean on all of the outcome items, questions number 25 to 32, was also calculated for each group. A chi-square statistical analysis was performed to compare the mean outcome that was calculated for the PBL group and the non-PBL group. A Mann-Whitney – Wilcoxon Rank Sum test was used to compare the mean ratings on all outcome items between the PBL group and the non-PBL group. The results of the data analysis are presented in the following chapter. A summary of the open-response items, which indicate other methods used by athletic training educators, will also be presented.
CHAPTER IV

RESULTS

This chapter is organized according to the research questions driving this study. The summary of data will begin with a description of the survey instrument and the population sample, including demographic characteristics. After the results of the data analysis are reported for each research question, a discussion presenting the results of further data analysis will follow. Tables are presented throughout the chapter to list pertinent data, and additional tables of the data were compiled and presented in the appendix. A discussion of results will follow in Chapter 5.

Survey Instrument and Population Sample

A reliability analysis was performed using Cronbach's alpha coefficient on the teaching method items and on the outcome items to assess internal consistency of the survey. Both the teaching method items and outcome items had a high degree of internal consistency, with an alpha coefficient of 0.83 and 0.89, respectively.

The population sample of this study included 101 CAAHEP accredited athletic training educators. Out of the 101 athletic training educators surveyed, 83 responded, yielding a return rate of 82%. Of the 83 educators that responded, 69 participants responded promptly, and 14 responded late. A chi-square statistical analysis revealed no significant difference between prompt and late respondents on survey items.

Demographic Profile

The data collected from the following ten survey items depict a demographic
profile of the sample: NCAA division, highest degree earned, possession of teaching credential and in what area, position and rank at institution, job responsibilities, years of teaching experience, number of courses instructed each year, and the average number of students in each course. The data are presented in Table 4.

The 101 survey respondents represented 24 universities/colleges in the United States, yielding an average of 4.2 educators per program. Out of the 101 educators, 65% are from a Division I program; 18% from a Division II program; and, 17% from a Division III program.

A Ph.D. or Ed.D was indicated as the highest degree earned by these athletic training educators. Thirty-two and a half percent of the respondents earned a Ph.D. or Ed.D degree, and 2% are in the process of earning a doctorate degree, currently having ABD status. The majority of respondents (60%) indicated a master’s degree as the highest degree earned. More than half (59%) of the athletic training educators have or have had a teaching credential with a specialization in one of the following areas: physical education, health education, both physical education and health, both physical education/health education and biology, biology, and general science.

The athletic training educators were predominantly in faculty positions (65%), with 32.5% in a tenured line and 32.5% in a non-tenured line; or, they were in staff positions (24%). The other educators had a faculty/staff position, a faculty in residence position, or a graduate assistantship. The educators ranked all throughout a range from an instructor to a full professor, with the majority of ranks falling at the instructor (44%) and assistant professor (34%) levels.

Respondents indicated the amount of time dedicated to athletic coverage,
classroom instruction, and other employment responsibilities. The percent of time dedicated to athletic coverage ranged from 0% to 95%, with 30% concentrated at 0% of total time and 17% at 50% of total time. Classroom instruction time ranged from 5% to 99%, of which a common response of 20% (12%) and 50% (18%) of total time was indicated. Seventy-one percent of educators indicated that they had other responsibilities in addition to athletic coverage and classroom instruction which include the following: program director duties, administrative duties, clinical instructor responsibilities, and research responsibilities. Out of these educators, the common responsibilities indicated were administrative duties and clinical instructor responsibilities. Time allotted for these other responsibilities ranged from 5% to 80%, with 25% and 50% of total time dedicated to other responsibilities being the most frequent response.

The athletic training educators represent a wide range of athletic training teaching experience, ranging from 1 year to 37 years. The average number of teaching experience years was 10.8. The majority of educators (63%) had less than 11 years of teaching experience. These educators teach an average of 4.3 courses per year.

In order to collect information on classroom size in relation to educational method, athletic training educators were asked to list courses they teach and the average number of students in each course. Educators teach an average of 2 courses comprised of less than twenty students, with a mean of 10.3 students in each class. Educators instruct an average of 1.6 courses containing over twenty students, with an average of 29.3 students in each course.
**Table 4: Demographic Characteristics**

<table>
<thead>
<tr>
<th>NCAA Division</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division I</td>
<td>54</td>
<td>65.1%</td>
</tr>
<tr>
<td>Division II</td>
<td>15</td>
<td>18.1%</td>
</tr>
<tr>
<td>Division III</td>
<td>14</td>
<td>16.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Highest Degree Earned</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master’s</td>
<td>50</td>
<td>60.2%</td>
</tr>
<tr>
<td>PhD/EdD</td>
<td>27</td>
<td>32.5%</td>
</tr>
<tr>
<td>DA</td>
<td>01</td>
<td>0.1%</td>
</tr>
<tr>
<td>ABD</td>
<td>02</td>
<td>0.2%</td>
</tr>
<tr>
<td>Other</td>
<td>03</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teaching Credential</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>49</td>
<td>59%</td>
</tr>
<tr>
<td>No</td>
<td>34</td>
<td>41%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area of Teaching Specialization</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Education</td>
<td>11</td>
<td>13.3%</td>
</tr>
<tr>
<td>Health Education</td>
<td>11</td>
<td>13.3%</td>
</tr>
<tr>
<td>Phys Ed/Health Ed</td>
<td>15</td>
<td>18.1%</td>
</tr>
<tr>
<td>PE/Health/Biology</td>
<td>05</td>
<td>06.0%</td>
</tr>
<tr>
<td>Biology</td>
<td>03</td>
<td>03.6%</td>
</tr>
<tr>
<td>General Science</td>
<td>02</td>
<td>02.4%</td>
</tr>
<tr>
<td>Other</td>
<td>01</td>
<td>01.2%</td>
</tr>
<tr>
<td>No response</td>
<td>35</td>
<td>42.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenure line</td>
<td>27</td>
<td>32.5%</td>
</tr>
<tr>
<td>Non-tenure line</td>
<td>27</td>
<td>32.5%</td>
</tr>
<tr>
<td>Staff</td>
<td>20</td>
<td>24.1%</td>
</tr>
<tr>
<td>Faculty/staff</td>
<td>05</td>
<td>06.0%</td>
</tr>
<tr>
<td>FIR</td>
<td>01</td>
<td>01.2%</td>
</tr>
<tr>
<td>Grad. Assist.</td>
<td>03</td>
<td>03.6%</td>
</tr>
<tr>
<td>Rank</td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>Instructor</td>
<td>36</td>
<td>43.5%</td>
</tr>
<tr>
<td>Assist. Professor</td>
<td>28</td>
<td>33.7%</td>
</tr>
<tr>
<td>Assoc. Professor</td>
<td>11</td>
<td>13.3%</td>
</tr>
<tr>
<td>Full Professor</td>
<td>07</td>
<td>08.4%</td>
</tr>
<tr>
<td>No response</td>
<td>01</td>
<td>01.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% Athletic Coverage</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>25</td>
<td>30.1%</td>
</tr>
<tr>
<td>1-25%</td>
<td>13</td>
<td>15.7%</td>
</tr>
<tr>
<td>30-60%</td>
<td>23</td>
<td>27.7%</td>
</tr>
<tr>
<td>65-95%</td>
<td>22</td>
<td>26.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% Classroom Instruction</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-30%</td>
<td>38</td>
<td>45.8%</td>
</tr>
<tr>
<td>35-60%</td>
<td>31</td>
<td>37.4%</td>
</tr>
<tr>
<td>70-99%</td>
<td>14</td>
<td>16.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% Other Responsibilities</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>29</td>
<td>34.9%</td>
</tr>
<tr>
<td>5-15%</td>
<td>07</td>
<td>08.4%</td>
</tr>
<tr>
<td>20-40%</td>
<td>33</td>
<td>39.8%</td>
</tr>
<tr>
<td>50-80%</td>
<td>14</td>
<td>16.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Responsibilities</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Director</td>
<td>05</td>
<td>06.0%</td>
</tr>
<tr>
<td>Administrative</td>
<td>18</td>
<td>21.7%</td>
</tr>
<tr>
<td>Clinical instructor</td>
<td>10</td>
<td>12.0%</td>
</tr>
<tr>
<td>Research</td>
<td>04</td>
<td>04.8%</td>
</tr>
<tr>
<td>Clin. Instr/Admin.</td>
<td>02</td>
<td>02.4%</td>
</tr>
<tr>
<td>Research/Admin.</td>
<td>02</td>
<td>02.4%</td>
</tr>
<tr>
<td>Dept. Chair</td>
<td>02</td>
<td>02.4%</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>12.0%</td>
</tr>
<tr>
<td>No response</td>
<td>30</td>
<td>36.1%</td>
</tr>
</tbody>
</table>
Table 4 Continued: Demographic Characteristics

<table>
<thead>
<tr>
<th>Years of Teaching Exp.</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>24</td>
<td>28.9%</td>
</tr>
<tr>
<td>6-10</td>
<td>21</td>
<td>25.3%</td>
</tr>
<tr>
<td>11-15</td>
<td>19</td>
<td>22.9%</td>
</tr>
<tr>
<td>16-20</td>
<td>10</td>
<td>12.0%</td>
</tr>
<tr>
<td>&gt;20</td>
<td>09</td>
<td>10.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Courses/year</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>34</td>
<td>41.0%</td>
</tr>
<tr>
<td>4-6</td>
<td>32</td>
<td>38.6%</td>
</tr>
<tr>
<td>7-9</td>
<td>17</td>
<td>20.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Credits/year</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-6</td>
<td>27</td>
<td>32.5%</td>
</tr>
<tr>
<td>7-12</td>
<td>27</td>
<td>32.5%</td>
</tr>
<tr>
<td>13-20</td>
<td>17</td>
<td>20.5%</td>
</tr>
<tr>
<td>21-30</td>
<td>12</td>
<td>14.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calendar system</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
<td>48</td>
<td>57.8%</td>
</tr>
<tr>
<td>Quarter</td>
<td>01</td>
<td>01.2%</td>
</tr>
<tr>
<td>Unspecified</td>
<td>34</td>
<td>41.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#Courses with &lt;20 Students</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>22</td>
<td>26.5%</td>
</tr>
<tr>
<td>1-3</td>
<td>46</td>
<td>55.4%</td>
</tr>
<tr>
<td>4-7</td>
<td>15</td>
<td>18.1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average # of Students (&lt;20)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-10</td>
<td>08</td>
<td>10.0%</td>
</tr>
<tr>
<td>11-15</td>
<td>38</td>
<td>45.8%</td>
</tr>
<tr>
<td>16-20</td>
<td>15</td>
<td>18.1%</td>
</tr>
</tbody>
</table>
### Table 4 Continued: Demographic Characteristics

#### #Courses with >20 Students

<table>
<thead>
<tr>
<th>Students</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>16</td>
<td>19.3%</td>
</tr>
<tr>
<td>1-3</td>
<td>59</td>
<td>71.1%</td>
</tr>
<tr>
<td>4-6</td>
<td>08</td>
<td>10.0%</td>
</tr>
</tbody>
</table>

#### Average # of Students (>20)

<table>
<thead>
<tr>
<th>Students (&gt;20)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-30</td>
<td>25</td>
<td>30.1%</td>
</tr>
<tr>
<td>31-40</td>
<td>31</td>
<td>37.4%</td>
</tr>
<tr>
<td>50-99</td>
<td>11</td>
<td>13.3%</td>
</tr>
</tbody>
</table>
Research Question One

What is the frequency of CAAHEP accredited athletic training educators currently using the PBL method or a variation of PBL?

Research question one addresses the frequency of athletic training educators employing PBL or types of PBL methods. Data was collected from the teaching method items for which respondents were instructed to rank teaching method items on a 1 to 6 Likert-type scale according to their use of each method, with 1 = “never” and 6 = “always”. A factor analysis confirmed the conceptual selection of the following teaching method items as representative of PBL methods: items #13, #14, and #17 to #21. Respondents who ranked item numbers 13 or 14, 17, 18 or 19, and 20 or 21 above the mean were selected as PBL method users and were placed in a PBL group. A rank of a 3 or higher was above the mean for each of the PBL item numbers. The means and standard deviations for each one of these PBL items are listed in Table 5. The number of respondents that were selected for the PBL group was 17, with the remaining 66 respondents belonging to a group that utilizes methods other than PBL, the non-PBL group.

<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>case prior to teacher-directed lecture</td>
<td>2.17</td>
<td>1.15</td>
</tr>
<tr>
<td>14</td>
<td>case after teacher-directed lecture</td>
<td>2.71</td>
<td>1.44</td>
</tr>
<tr>
<td>17</td>
<td>student-centered; explore case studies</td>
<td>2.30</td>
<td>1.31</td>
</tr>
<tr>
<td>18</td>
<td>student-centered; explore partial text cases</td>
<td>2.30</td>
<td>1.45</td>
</tr>
<tr>
<td>19</td>
<td>student-centered; explore complete text cases</td>
<td>2.12</td>
<td>1.31</td>
</tr>
<tr>
<td>20</td>
<td>student-centered; explore partial real cases</td>
<td>2.76</td>
<td>1.50</td>
</tr>
<tr>
<td>21</td>
<td>student-centered; explore complete real cases</td>
<td>2.94</td>
<td>1.60</td>
</tr>
</tbody>
</table>

The 17 respondents were selected as those educators utilizing all PBL methods, as identified by their ranks on PBL items. Although these 17 respondents use all of the...
identified PBL methods, there are other respondents that use one or more of the PBL methods. The frequency of use of each type of PBL method will be presented using the individual cases that selected a rank above the mean of 3 on each PBL item (Table 4). The PBL items #13 and #14 present teacher-directed methods that utilize case studies to highlight lecture material. The frequency of respondents (n=83) indicating that they used these PBL methods was 22 for item #13 and 40 for item #14. Item #17 highlights a student-centered learning method in which students explore real-life or textbook cases. The frequency of a response (n=83) above the mean for item #17 was 31. PBL items #18 and #19 present a student-centered learning method that specifically utilizes textbook case studies that may either be complete or partial. A frequency (n=83) of 27 was calculated for item #18 and a frequency of 25 for item #19. Items #20 and #21 highlight a student-centered learning method that explores real-life case studies that are presented in a complete or partial format. The frequency of respondents (n=83) indicating a rank above the mean for PBL item #20 and for PBL item #21 was 44 and 46, respectively.

There are 17 cases that indicate the use of all PBL methods. These cases were grouped because they ranked all of the PBL methods above the mean. When PBL method items were analyzed individually and not as a group, a frequency of PBL use ranged from 22 to 46 educators (out of 83), indicating that 55% (n=46) of all respondents utilize a PBL method that highlights student-centered learning around real-life complete cases. Table 6 lists the frequencies and percentages of responses to each of the PBL item numbers.
Table 6: PBL Item Statistics (n=83)

<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>1 “never”</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6 “always”</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>case prior to teacher-directed lecture</td>
<td>10(12)</td>
<td>08(9.6)</td>
<td>03(3.6)</td>
<td>01(1.2)</td>
<td>22(27)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>case after teacher-directed lecture</td>
<td>14(16.9)</td>
<td>14(16.9)</td>
<td>10(12)</td>
<td>02(2.4)</td>
<td>40(48)</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>student-centered; explore case studies</td>
<td>17(20.5)</td>
<td>06(7.2)</td>
<td>07(8.4)</td>
<td>01(1.2)</td>
<td>31(37)</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>student-centered; explore partial text cases</td>
<td>10(12)</td>
<td>07(8.4)</td>
<td>07(8.4)</td>
<td>03(3.6)</td>
<td>27(33)</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>student-centered; explore complete text cases</td>
<td>12(14.5)</td>
<td>06(7.2)</td>
<td>06(7.2)</td>
<td>01(1.2)</td>
<td>25(30)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>student-centered; explore partial real cases</td>
<td>17(20.5)</td>
<td>16(19.3)</td>
<td>07(8.4)</td>
<td>04(4.8)</td>
<td>44(53)</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>student-centered; explore complete real cases</td>
<td>20(24.1)</td>
<td>08(9.6)</td>
<td>11(13.3)</td>
<td>07(8.4)</td>
<td>46(55)</td>
<td></td>
</tr>
</tbody>
</table>

Research Question Two

For those athletic training educators using PBL or a variation of PBL, what is their opinion and attitude on the educational outcomes of this method?

Research question two addresses the opinions and attitudes of faculty using PBL methods on the effectiveness of PBL methods in attaining educational outcomes. Respondents were asked to rate the following eight outcomes in relation to the educational methods they employ, on a 1-6 Likert-type scale, with 1 indicating strong disagreement and 6 strong agreement: (#25) students’ high interest and enthusiasm; (#26) students’ knowledge of anatomy, physiology, and kinesiology; (#27) students’ understanding and ability to apply athletic training concepts to the clinical experience; (#28) students’ self-directed learning; (#29) students’ effective clinical reasoning ability; (#30) students’ preparation for the certification exam; (#31) teacher’s personal satisfaction; and, (#32) overall value to students. Each of these items was analyzed individually as opinions, and collectively as a measure of attitude.

The data analysis on teaching methods identified 17 cases that use all PBL methods. These 17 respondents utilize all of the PBL methods highlighted in the survey; therefore, they represent the PBL faculty as a group. The PBL faculty opinion of PBL methods is high with mean ratings on each outcome item ranging from a 4.59 to a 5.35.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
The lowest rated outcome item was #28 (4.59) which highlighted self-directed learning skills. Outcome items #25 and #26, which identified student interest and student preparation for the national certification exam, were also on the low end of the range (4.71). Outcome items #26 and #27, knowledge acquisition and ability to apply knowledge, were at the high end of the range, with a mean of 5.12 and 5.35, respectively. The mean on all outcome items, used as a measure of overall attitude of PBL faculty in regards to their educational methods, was 4.92. This indicates the PBL faculty has a favorable attitudes toward the effectiveness of PBL as a method to achieve educational outcomes. The frequency distribution of PBL faculty (n=17) responses, along with the mean and standard deviation for each outcome item, and the mean calculation on all eight outcome items are presented in Table 7.

Table 7: PBL Group (n=17) Ratings on Outcome Items

<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>Fr. (%)</th>
<th>Fr. (%)</th>
<th>Fr. (%)</th>
<th>Fr. (%)</th>
<th>Fr. (%)</th>
<th>Fr. (%)</th>
<th>Fr. (%)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>student interest</td>
<td>N/A</td>
<td>N/A</td>
<td>1(5.9)</td>
<td>6(35.3)</td>
<td>7(41.2)</td>
<td>3(17.6)</td>
<td>4.71</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>knowledge acquisition</td>
<td>N/A</td>
<td>N/A</td>
<td>2(11.8)</td>
<td>2(11.8)</td>
<td>5(29.4)</td>
<td>8(47.1)</td>
<td>5.12</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>understand/apply know.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>2(11.8)</td>
<td>7(41.2)</td>
<td>8(47.1)</td>
<td>5.35</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>self-directed learning</td>
<td>N/A</td>
<td>N/A</td>
<td>2(11.8)</td>
<td>4(23.5)</td>
<td>10(58.8)</td>
<td>1(5.9)</td>
<td>4.59</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>clinical reasoning</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>4(23.5)</td>
<td>12(70.6)</td>
<td>1(5.9)</td>
<td>4.82</td>
<td>0.53</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>prep. for cert. exam</td>
<td>N/A</td>
<td>1(5.9)</td>
<td>2(11.8)</td>
<td>1(5.9)</td>
<td>7(41.2)</td>
<td>6(35.3)</td>
<td>4.88</td>
<td>1.22</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>teacher’s satisfaction</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>6(35.3)</td>
<td>7(41.2)</td>
<td>4(23.5)</td>
<td>4.88</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>overall value to students</td>
<td>N/A</td>
<td>N/A</td>
<td>1(5.9)</td>
<td>4(23.5)</td>
<td>6(35.3)</td>
<td>6(35.3)</td>
<td>5.00</td>
<td>0.94</td>
<td></td>
</tr>
</tbody>
</table>

Mean on all outcome items (attitude) 4.92 0.60

Research Question Three

What other methods are athletic training educators employing in the education of their student athletic trainers?

Whereas research question one addressed the frequency of educators employing
PBL methods, research question three addresses the other methods utilized by athletic training educators. There were 17 respondents that were identified as a group of faculty that use PBL methods. The other 66 respondents did not employ PBL methods and were placed in a non-PBL group of faculty. The non-PBL respondents utilize the traditional methods that were identified both conceptually and by factor analysis. The traditional method items include #11, #12, and #16.

Item #11 presents a teacher-directed method used to explain information, ideas, etc. The non-PBL group (n=66) had a mean rating of 5.08 on item #11, with 81% of non-PBL respondents ranking the use of this method as a 5 or greater on a scale of 1-6. Item #12 highlights a teacher-directed questioning method, for which the non-PBL group had a mean rating of 4.80. 71.1% of non-PBL respondents ranked method item #12 as a 5 or 6. The last traditional method, item #16, presents a teacher-directed lecture that demonstrates an inquiry strategy. The mean rating on item #16 by the non-PBL group was 3.81, with 61.4% of respondents ranking the use of this method as a 4 or greater.

The frequency distribution of the non-PBL group (n=66) responses, including the means and standard deviations are presented in Table 8.

<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Fr.(%)</th>
<th>Fr.(%)</th>
<th>Fr.(%)</th>
<th>Fr.(%)</th>
<th>Fr.(%)</th>
<th>Fr.(%)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>teacher-directed lecture</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.20</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>teacher-directed question</td>
<td>N/A</td>
<td>2(3.0)</td>
<td>8(12.1)</td>
<td>31(47.0)</td>
<td>25(37.9)</td>
<td>4.77</td>
<td>1.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>teach-dir demo of strategy</td>
<td>9(13.6)</td>
<td>7(10.6)</td>
<td>14(21.2)</td>
<td>18(27.3)</td>
<td>11(16.7)</td>
<td>7(10.6)</td>
<td>3.55</td>
<td>1.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The two other teaching method items on the survey instrument were items #15 and #22. Item #15 presents a teacher-directed lesson in which the instructor moderates a
discussion of material, and item #22 highlights assigned activities that require students to seek multiple resources for study. Item #15 was originally defined as a traditional method item, however a factor analysis revealed it loaded on the PBL factor. A reliability analysis of the PBL items indicated a strong reliability of PBL items with the deletion of item #15. For both this reason and its conceptual fit with traditional methods, item #15 was removed from the group of PBL method items and will be analyzed individually according to its rating by all respondents. Item #22 was identified as its own factor by the factor analysis, and it will also be analyzed individually using the responses of all respondents.

The mean rating of method item #15 by all respondents (n=83) was 3.54, with 55.4% of all respondents selecting a rating above the mean. This indicates that more than half of all respondents utilizes a teacher-directed method in which the teacher moderates class discussion of material. Respondents (n=83) indicated a mean rating of 4.41 on item #22. A total of 60.2% of all respondents ranked this method over the mean indicating that the majority of educators utilize assignments that require the search and use of resources for study.

In addition to the twelve closed-response teaching method items, there were two open-response items that requested the names of other methods used by respondents. The list of these methods is organized into responses from the PBL group and responses from the non-PBL group and is presented in Table 9. The frequency distribution of responses, and the means and standard deviations for all teaching method items, #11-#22, from all respondents (n=83) are presented in Appendix D.
Table 9: Other Methods Employed by Athletic Training Educators

<table>
<thead>
<tr>
<th>PBL Group (n=17)</th>
<th>Non-PBL Group (n=66)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SOAP note writing</td>
<td>1. Cooperative learning</td>
</tr>
<tr>
<td>2. Incorporate prior courses in assignments</td>
<td>2. Small group problems/situations</td>
</tr>
<tr>
<td>3. Small group discussions of objectives</td>
<td>3. In-class scenarios</td>
</tr>
<tr>
<td>4. Paper patients</td>
<td>4. Web-based lectures and discussion</td>
</tr>
<tr>
<td>5. Critical incident assignments</td>
<td>5. Web-based group or individual exploration</td>
</tr>
<tr>
<td>6. Literature review assignments</td>
<td>6. Small group/partner discussions</td>
</tr>
<tr>
<td>7. Hands-on labs</td>
<td>7. Critical thinking/active learning</td>
</tr>
<tr>
<td>8. Proficiency check-offs</td>
<td>8. Video case problems</td>
</tr>
<tr>
<td>9. Apply “Covey’s 7 Habits” to AT</td>
<td>9. Collaborative learning</td>
</tr>
<tr>
<td></td>
<td>10. Reaction papers</td>
</tr>
<tr>
<td></td>
<td>11. Technology-based projects</td>
</tr>
<tr>
<td></td>
<td>12. Lab application of techniques</td>
</tr>
<tr>
<td></td>
<td>13. Interactive computer assignments</td>
</tr>
<tr>
<td></td>
<td>14. Integrated course projects</td>
</tr>
<tr>
<td></td>
<td>15. Presentations/demonstrations</td>
</tr>
<tr>
<td></td>
<td>16. Writing assignments</td>
</tr>
</tbody>
</table>

Research Question Four

For those athletic training educators using methods other than PBL, what is their opinion and attitude on the educational outcomes of these methods?

Research question four considers the opinions and attitudes of faculty using methods other than PBL methods on the effectiveness of other methods in regards to educational outcomes. To address this question, the outcome item responses of the respondents that were identified in the non-PBL group (n=66) were analyzed. Again, an analysis was performed on individual outcome items, representing opinions; and, an analysis was performed collectively by calculating a mean on all outcome items, representing a measure of attitude.

The non-PBL respondent opinions on the outcomes of their instruction ranged

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
from a mean rating of 3.97 to 4.97, indicating the non-PBL faculty has favorable opinions of their teaching methods. Outcome item #28 which highlights self-directed learning had the low mean rating of 3.97; and item #29 which highlights clinical reasoning ability was also on the low end with a mean rating of 4.32. Outcome items #27 and #32, which identify the ability to apply knowledge, and overall value to the students, were at the high end of the range, with a mean of 4.97 and 4.86, respectively. The mean on all outcome items, which is a measure of faculty attitude, for the non-PBL group was a 4.59. This indicates that the non-PBL faculty, who are those that use methods other than PBL, has a favorable attitudes regarding their methods of instruction. The frequency distribution of non-PBL faculty (n=66) responses, along with the mean and standard deviation for each outcome item, and the mean calculation on all eight outcome items are presented in Table 10. The frequency distribution, means and standards deviation of responses (n=83) to the outcome items, #25-#32, are presented in Appendix E.

**Research Question Five**

How are factors such as teaching background, typical class size, years of teaching, highest degree held, and percent of time dedicated to classroom teaching related to the
type of teaching method utilized by an educator?

Research question five addresses the relationship between demographic characteristics and the type of educational method selected by an educator. Two groups have been identified, a PBL group and a non-PBL group, as using different types of educational methods. The PBL group utilizes PBL methods as an educational strategy and the non-PBL group employs methods other than PBL. The data analysis revealed that the non-PBL group utilizes traditional teaching methods, such as a teacher-directed lecture.

A comparison was made using chi-square statistical analyses between these two groups on each of the following demographic characteristics: highest degree earned, possession of teaching credential, percent of total time dedicated to classroom instruction, years of teaching experience, and classroom size (less than or greater than 20 students). The chi-square statistics revealed no significant difference between the PBL group and the non-PBL group across all demographic characteristics. This result suggests that there is no relationship between demographic characteristics and the type of instructional method employed by athletic training educators.

Other Findings

In further analysis of the data, a comparison was made between the PBL group and the non-PBL group on individual outcome items and on the mean of outcome items to identify a difference between opinions and attitudes of each group regarding the methods they employ. A chi-square analysis revealed no significant difference between the PBL group and the non-PBL group on individual outcome items. Figure 1 presents the means on outcome items for the PBL group and non-PBL group. A chi-square
analysis also revealed no significant difference between the PBL and non-PBL groups on the mean of all outcome items. The mean of all outcome items for both the PBL group and the non-PBL group were both high, with a mean of 4.92 for PBL group and a mean of 4.56 for the non-PBL group. This analysis suggests that athletic training educators have favorable opinions and attitudes concerning the effectiveness of their educational methods, regardless of what method they employ.

As reported, the chi-square analysis indicated that there was not a significant difference on overall means of outcome items between the PBL and the non-PBL group. In order to analyze this further, a Mann-Whitney U-Wilcoxon Rank Sum W Test was performed on the means of all outcome items for the PBL group and non-PBL group. This analysis was selected to determine whether the distribution of scores of the PBL group and the non-PBL group differ significantly from each other. The Mann-Whitney U analysis revealed a mean rank of 51.71 for the PBL group (n=17) and a mean rank of 39.50 for the non-PBL group (n=77), which was statistically different at the p<.03 level.
(Figure 2). This analysis indicates that although PBL and non-PBL groups do not differ on the means of all outcome items, they do differ on the distribution of scores. The athletic training educators that employ PBL methods rate their methods consistently higher on all outcome items than the athletic training educators who use other teaching methods.

![Figure 2: Perceptions of PBL and Non-PBL Faculty on Effectiveness of their Teaching Methods](image)

*denotes significance (p<0.03)

**Summary**

The data analysis of survey responses presented in this chapter indicates 20% of the athletic training educators utilize PBL methods, and the other 80% of educators utilize methods other than PBL, such as the traditional lecture method. Both the educators that use PBL and the educators that use other methods have favorable opinions and attitudes toward the effectiveness of their educational methods in regards to them meeting educational outcomes. Although there is no significant difference between opinions and attitudes of PBL educators and non-PBL educators concerning the
effectiveness of their methods, the educators that utilize PBL methods differ in that they consistently rank their methods higher on all outcomes when compared to the educators using other methods. Further description and discussion of findings will appear in the following chapter.
CHAPTER V

DISCUSSION

Overview of Study

Athletic training professionals have made great efforts over the past decade to reform athletic training education. One of the major issues driving the reform of athletic training education was the need for more consistent educational preparation of an entry-level athletic trainer. Currently, athletic trainers earn eligibility for certification through graduation from a Commission on Accreditation of Allied Health Educational Programs (CAAHEP) accredited curriculum program or from an internship program. The curriculum programs are directed by national standards and guidelines as well as the educational objectives outlined by the National Athletic Trainers' Association (NATA). Internship programs do not adhere to a prescribed curriculum; however, the students of the internship route have to acquire 700 more clinical experience hours than the curriculum students, requiring a total of 1500 hours.

The inconsistency of these two educational preparatory programs for athletic training certification has resulted in an ambiguous definition of an entry-level athletic trainer. For this reason, athletic training has had difficulty fighting state legislation to gain recognition as health care practitioners, joining the health care front with other allied health professions such as physical therapy and occupational therapy. The first step in athletic training education reform was the decision to abandon the internship route beginning in the year 2004, and to commit to a single educational route to certification.
This change will standardize the education of an entry-level athletic trainer and will provide a foundation for the athletic training profession as members lobby for state licensure and a place in the health care community.

New educational competencies, encompassing a broad body of knowledge, including two new domain areas in pharmacology and pathology, have been drafted by the NATA Educational Council and will come into effect September 2001. Athletic training educators, who wish to house a CAAHEP accredited athletic training educational program, are responsible for addressing all of the educational competencies. The additional content areas that need to be covered pose a challenge for athletic training educators, especially those who are accustomed to teaching in trade within the internship programs. These athletic training educational changes give rise to a need for research in education, especially in the area of instructional strategies. Research on instructional strategies will provide an intellectual resource for athletic training educators searching to improve their educational methods.

During the deliberation over educational reform, the Educational Task Force recognized the need to improve the quality of athletic training instruction. The task force also noted a need to prepare the entry-level athletic trainer for a lifetime of learning in the rapidly expanding body of knowledge surrounding sports medicine. Currently, athletic training education literature does not address educational strategies and is limited to studies examining clinical education. With this limited resource base in athletic training literature, an examination of the literature on educational strategies in other allied health professions and medicine was warranted. This investigation of the literature found an educational approach that was consistently reported in both medical and allied health
The definition and implementation of PBL is described in the literature in a variety of ways. Although the processes of the PBL method may differ, they are all based on the same premise. That premise is PBL is learning that results through the resolution of problems (Barrows and Tamblyn, 1980). The problems used in medical and allied health education are clinical in nature. Problems are presented as ill-structured, real-life, patient problems in the form of a case history or simulation scenario. The problem has to be one in which the students have the adequate background knowledge to understand it and yet require additional information to resolve it. PBL problems are chosen according to the educational objectives drafted for the course or unit. PBL sessions begin with the students’ encountering of a problem.

This current study investigated the existing PBL literature to define a working definition of PBL, involving its process. In a PBL learning environment, students work in small groups consisting of four to five students and a faculty member in the role of a tutor. The students begin by discussing the problem and generating several working hypotheses. Students then engage in a problem-solving strategy that involves the collection of facts and the synthesis of new and existing information in order to deduce fewer hypotheses. The emphasis is on the learning that results from working through the problems, not the resolution of the problem. This problem-solving process is referred to as the hypothetico-deductive reasoning process, which is the reasoning process used by medical experts. After an initial discussion of the problem, the group generates multiple learning issues that will be used to guide a period of self-study as they prepare to revisit the problem on the next occasion. During the self-study period, students are encouraged
to use multiple resources to gather pertinent information to the problem. The students return with their new information and revisit the problem in the same thorough manner as their initial attempt. The PBL session ends with an analysis of resources used and an assessment, both self and peer, of the clinical reasoning process used in the resolution of the problem.

PBL was implemented in medical and allied health educational programs in an attempt to employ a more effective method than traditional methods in the education of their students. Educators criticized traditional teaching methods, primarily the teacher-directed lecture style, for the inadequacies found in graduating students. Researchers observed that students had poor retention of knowledge, ineffective clinical reasoning ability, limited self-directed learning skills, and lack of motivation to learn (Rouse, 1990). These deficiencies in the students led to the criticism of the effectiveness of the traditional method and the search for a new innovative method, specifically PBL. It is imperative that students in medicine and any allied health profession, such as athletic training, have effective clinical reasoning skills and self-directed learning skills. Students need not only to retain a broad knowledge base, but they need to have the skill to apply it clinically. An inability to do so can result in a fatal mistake by the health practitioner. Self-directed learning skills will enable health professionals to remain adept on the ever-changing medical field. A lack of life-long learning skills can also result in a mistake by the practitioner who is not current with medical literature. PBL claims to structure knowledge in a clinical context, develop an effective clinical reasoning process, develop self-directed learning skills, and invoke motivation to learn (Barrows, 1986).

PBL, including its definition, implementation, and effectiveness, has been well...
documented in the medical and allied health education literature. Many outcome studies have been performed investigating the effectiveness of PBL as compared to traditional methods with variables such as academic performance, clinical performance, self-directed learning, and motivation or interest in learning. These studies concluded little to no significant difference between PBL and traditional methods. Other studies that examined student and faculty opinions and attitudes regarding the effectiveness of PBL found that both students and faculty perceived PBL as more enjoyable than traditional methods. There are no current studies in athletic training education literature that investigate PBL. One study in athletic training education (McLoda, 1996), examined the applicability of PBL to athletic training education and found a strong interest in PBL by athletic training educators. This current investigation sought to identify the athletic training educators currently using PBL, and ascertain their opinions and attitudes on the effectiveness of PBL.

Re-statement of the Problem

The NATA recognized a need to improve the consistency and quality of athletic training instruction (NATA, 1996). Research efforts have been made in the area of improving clinical education, but they are limited in the area of formal instructional strategies. For this reason, a foundation can be built by examining the educational literature of professions that parallel athletic training such as physical therapy and medicine. PBL has been documented throughout the medical and allied health profession literature as an effective approach over traditional educational methods, although there has been no or minimal statistical significance reported between the two methods. With a strong use of PBL reported (Jonas et al., 1989) in medical schools and a strong interest in
PBL by athletic training educators, it is reasonable to suspect that PBL is currently being employed in athletic training education. This study aims to identify athletic training educators using PBL and to examine the effectiveness of PBL as perceived by these educators. More specifically, this study will address these questions:

1. Frequency of CAAHEP accredited athletic training educators currently using the PBL method or a variation of PBL?
2. For those athletic training educators using PBL or a variation of PBL, what is their opinion and attitude on the educational outcomes of this method?
3. What other methods are athletic training educators employing in the education of their student athletic trainers?
4. For those athletic trainers using methods other than PBL, what is their opinion and attitude on the educational outcomes of these methods?
5. How are factors such as teaching background, typical class size, years of teaching, highest degree held, and percent of time dedicated to classroom teaching related to the type of teaching method used by an educator?

Summary of the Procedures

The distribution of a survey instrument to CAAHEP accredited athletic training educators (n=101) was the method of choice for this investigation. The survey instrument was created from a thorough investigation of the literature on PBL. The survey contained 33 items, 20 closed-response and 3 open-response, and was divided into a demographic section, teaching method section, and outcome section. The demographic items were chosen to depict a profile of the athletic training teachers’ educational background and experience. The teaching method items presented several teaching-
learning methods that were either PBL or traditional, and participants were asked to rate their use of each method during a typical week on a 1 to 6 rating Likert scale. The outcome items highlighted several educational outcomes such as teacher satisfaction, and participants were asked to rate the effectiveness of their methods in achieving each outcome item on a 1 to 6 scale.

The return of surveys yielded an 82% response rate. Respondents were placed into two groups, a PBL group and a non-PBL group. Respondents that scored high on the PBL items, #13-#14 and #17-#21, were selected for the PBL group (n=17). The PBL items were identified both conceptually and through a factor analysis. Respondents that did not score high on the PBL items were placed in a non-PBL group (n=66), which suggested they used traditional methods. Survey items that conceptually presented traditional teaching methods were items #11, #12, and #16. These items were also confirmed by factor analysis as loading on one factor. Survey item #22 loaded on a third factor and stood by itself. Frequencies, means and standard deviations were calculated across demographic, teaching method and outcome responses for all respondents. Non-parametric statistics were used to compare the demographic and outcome responses of the PBL and non-PBL group.

Discussion of Findings

Athletic Training Educators

The educators who participated in this study have diverse educational and teaching backgrounds. Only one-third of the educators has a terminal degree, with a majority possessing a master's degree as their highest degree. This would explain why the majority of positions held by these athletic training educators are instructor ranked
positions in a non-tenure or staff line. One-third of the educators did hold a tenure-track line with a range in rank from assistant professor to full professor. About half of the educators possess or have possessed a teaching credential, most commonly in the area of physical education and health. For the most part, these educators were early in their careers with the majority having taught in athletic training for less than 10 years.

Athletic training educators have different roles than the majority of other higher education faculty. Typically, teaching faculty has the responsibility to teach, engage in scholarly activities, and provide service to the college community. Athletic training educators have these same responsibilities as well as an additional clinical component including responsibilities such as the provision of athletic coverage as a practicing certified athletic trainer and the supervision of student athletic trainers in their clinical experience. The majority of the educators in this study claimed to spend the majority of their time providing athletic coverage. The time spent with athletic coverage and other aspects of the clinical field can be time-consuming. Athletic coverage alone involves pre and post practice treatments and athletic practice and event coverage.

The majority of educators also indicated that they allot less than 30% of their time to classroom instruction. Each educator surveyed teaches an average of 4 courses per year. In addition to athletic coverage and teaching responsibilities, 24% of educators are committed to administrative duties, 6% have program director duties, 15% are clinical instructors, and as few as 7% partake in research activities. The result that few educators are actively researching relates to the low number of athletic training educators with terminal degrees. The terminal degree prepares one for research, and with very few athletic training educators possessing a Ph.D., there is likely very few researchers

87
focusing on the elements within the field of athletic training. Three percent of the respondents did indicate that they were of ABD status and there may have been others that were pursuing a Ph.D. but were not identified. The reform of athletic training education calls for professionals with terminal degrees who can actively pursue research in athletic training education.

PBL in Athletic Training

This study revealed two major findings regarding the use of PBL in athletic training education. Results indicate that there is one group of educators, approximately one-fifth of the total sample, that use all of the PBL methods highlighted in the survey, and there is a large group of educators that uses variations of the PBL method during a typical teaching week. The one group of educators that utilize all of the PBL methods listed on the survey was placed in the PBL group because they were the respondents that scored high on all of the PBL items that were identified conceptually and by factor analysis. This group was selected to distinguish PBL users from non-PBL users, overall. However, if a respondent was not selected for the PBL group, it does not mean that s/he did not use a type of PBL method. In fact, there may have been only 17 respondents using all of the PBL methods, but the majority of the respondents indicated that they use two of the PBL methods identified on the survey during a typical week of teaching. The PBL methods used by these educators highlight student-centered learning that is based on exploration of complete or partial, real-life case histories. PBL methods that are student-centered and based on real-life case histories in which only a portion of the material is given are considered strong PBL methods according to Barrows’ (1986) taxonomy of PBL. The finding that the majority of all athletic training educators are using these PBL
methods indicates PBL is certainly being used in athletic training education. It can also be concluded that many athletic training educators are using student-centered and case-based techniques in the classroom.

In addition to the two PBL methods mentioned above, the educators also claim that they use the lecture-case based method that explores case histories after a lecture to reinforce material that was covered in a lecture. This may not be one of the stronger PBL methods, but almost half of the respondents used this method during a typical teaching week. This result shows that educators are incorporating other methods into the traditional classroom. Case studies are being used to generate thought and critical thinking and to reinforce the transmission of knowledge. The remaining PBL method items presented in the survey were student-centered learning methods based on the exploration of textbook case histories. About one-third of all educators surveyed claimed to use these types of PBL methods. This figure does not represent the majority of educators, but it does include more teachers than the 17 in the PBL faculty group. Again, this shows that educators are using student-centered methods and case-based methods. With the majority of educators claiming that they use student-centered methods that explore real-life cases, it is understandable that the minority is using textbook cases. According to the literature review in this study, PBL methods are more effective if they are based on real-life cases.

In conclusion, athletic training educators are using methods other than the traditional lecture. They are using many variations of the PBL method. Educators are incorporating PBL techniques with their lectures, and they are using problem-solving techniques in the form of student-centered discussions of real-life patient cases.
However, there are only a few educators that utilize the entire range of PBL methods presented.

**Other Methods in Athletic Training**

In order to offer additional responses for educators who do not use PBL, survey items were included in the survey to highlight other teaching methods, specifically traditional teaching methods. These teacher-directed methods were present in items #11, #12, and #16. The majority of educators claim that they use a teacher-directed lecture method to present information. The majority also claims that they use a technique of teacher-directed questioning to monitor student understanding of information and a teacher-directed method that involves a demonstration of sequence or strategy. These methods are the traditional teaching methods and it was expected that these methods were being used frequently by athletic training educators during a typical week of teaching. This finding reveals that the majority of athletic training educators use traditional teaching techniques during a typical teaching week. If this finding is considered with the previous finding that athletic training educators are using PBL methods, then it can be concluded that athletic training educators are employing both traditional and PBL approaches to athletic training education. This also suggests that the educators may be utilizing or combining different teaching techniques to accomplish different educational objectives.

Two other methods highlighted in the teaching method section of the survey were item #15, which presented a teacher-directed lecture in which the teacher moderates discussion of material; and, item #22, which involves the assignment of self-study activities. The majority of athletic training educators claim that they use these methods
during a typical teaching week. Again, this finding supports the notion that educators are using alternative or additional methods to the teacher-directed lecture. With the one method, the teacher is encouraging active student participation and is generating an environment of critical thought. The other method encourages students to develop self-directed learning skills.

The athletic training educators surveyed were also asked to list any other methods they use during a typical week of teaching. Several methods were noted such as cooperative learning, collaborative learning, web-based discussions, small group discussions, and discussions of video case problems. These methods were selected from a list of many other innovative methods that were identified by athletic training educators. This suggests that in addition to traditional methods and PBL methods, athletic training educators are using other innovative methods in the instruction of student athletic trainers.

In conclusion, athletic training educators are using many other methods to supplement or replace traditional teaching methods. They are using many innovative formats in addition to PBL methods. The traditional teaching methods continue to preside as the foundational methods used in athletic training education, however the importance of incorporating other methods is evident.

Opinions and Attitudes of Faculty about their Teaching Methods

Overall, all of the athletic training educators in this study rated their methods high regarding the following outcomes:

- students' high interest and enthusiasm
- students' knowledge of anatomy, physiology and kinesiology
• students’ understanding and ability to apply athletic training concepts to the clinical experience
• students’ self-directed learning
• students’ effective clinical reasoning ability
• students’ preparation for the certification exam
• teacher’s personal satisfaction
• overall value to the students

Each outcome item was analyzed individually as opinions and all outcome items were analyzed collectively as a measure of attitude. The fact that the educators rated their methods high on each outcome indicates that athletic training educators have favorable opinions and attitudes about their teaching methods. This suggests that athletic training educators are comfortable with the methods they are currently employing in spite of the need addressed by the NATA’s educational reform for improvement in the quality of athletic training instruction.

To determine if there was a difference in opinions and attitudes of faculty using PBL methods and faculty using other methods, the data were divided into a PBL group and a non-PBL group and a comparison was made using a chi-square analysis. The chi-square analysis revealed that there is no significant difference between the PBL group and the non-PBL group on the outcome items (opinions) and on the mean of all outcome items (attitude). This finding reveals that the faculty of PBL and the faculty of other teaching methods do not differ in their opinions and attitudes regarding the effectiveness of their teaching methods. In fact, both groups perceive each of their respective methods as effective in addressing the educational outcome items. It was interesting that both
groups rated the outcome, students' self-directed learning skills, the lowest out of all of the outcomes, and they both rated the outcome, students' understanding and ability to apply knowledge in a clinical context, the highest. This suggests a common concern among all of the educators that athletic training students are not developing the necessary self-directed learning skills that will facilitate the life-long learning of a practitioner in an allied health field.

Although there was no significant difference between opinions and attitudes of PBL faculty and non-PBL faculty, further investigation was pursued to determine if there was a difference in the distribution of scores between the two groups. A Mann-Whitney U-Wilcoxon Rank Sum statistic was performed and revealed that there was in fact a significant difference in the distribution of scores. The PBL faculty rated the effectiveness of their methods consistently higher than the faculty that used other methods. This indicates that although opinions and attitudes of the PBL faculty and the non-PBL faculty do not differ and are both favorable of their respective method, the PBL faculty consistently rates the effectiveness of their methods high. It can be concluded that the educators who employ PBL methods find their methods more favorable than the educators that use other methods.

In sum, it can be concluded that athletic training educators have favorable opinions and attitudes about the effectiveness of their methods, regardless of what type of method they employ. This result implies that PBL methods are equally effective as traditional methods according to faculty opinion. In a study on PBL faculty opinions and attitudes toward PBL, Vernon (1995) concluded that the results of his study support other PBL outcome studies, suggesting that strongly held faculty opinions might have a factual
basis. If faculty opinions have a factual basis, then it would be suggested that all of the methods used by athletic training educators are effective in meeting the educational outcomes identified in this study. The implication that faculty opinions have a factual basis is questionable considering the results of this study that indicate all educators believe the methods they use are effective, whether it is PBL or any other method. It is reasonable to also conclude that educators may be biased in evaluating their own methods because the teaching methods they choose are most likely the ones they find to be effective and enjoyable. It is difficult to believe that all of the methods identified in this survey are equally effective in meeting the outlined educational outcomes. Future research should utilize objective measures of outcomes to ascertain the effectiveness of PBL.

Relationship between Demographics and Teaching Method Employed

The data analysis revealed that there was no significant difference across demographic items between the educators who use PBL and the educators that use other methods. The purpose of research question five was to identify a relationship between educational background and the type of teaching method used by an educator. It was hypothesized that there may be a difference in demographics between the educators who use PBL and the ones that use other methods. An example of where a difference was sought was in the demographic item that highlighted the highest degree earned by each respondent. It was hypothesized that educators with terminal degrees may be more apt to employ innovative methods such as PBL. The majority of the PBL group members held a Ph.D. or Ed.D. degree and only one-quarter of the non-PBL group members held a terminal degree; however, this was not statistically significant. The lack of significance
can be attributed to the overall limited number of educators in this study who possess
terminal degrees.

Another area where a difference was expected between the PBL group and the
non-PBL group was regarding job responsibilities. It was reasonable to suggest that
educators who allotted more time to classroom instruction would have the time to
investigate and implement new educational methods, such as PBL. This was not a
variable because the majority of educators allotted less than 30% of their time to
classroom instruction. The last area where a difference was expected was regarding the
typical class size. It was hypothesized that educators who had a smaller number of
students in their classes would more likely attempt to implement methods such as PBL.
There was no significant difference reported between the PBL faculty and the non-PBL
faculty concerning class size. The majority of educators indicated they taught both small
and large class sizes. In sum, the demographic profiles of the educators using PBL and
those educators using other methods are similar. Thus, in this case, the demographic
characteristics of athletic training educators are not related to the type of methods the
educators employ.

Limitations

The results of this study indicate that PBL methods are being used in athletic
training education and that the faculty using these methods perceives PBL as effective in
attaining important educational outcomes. Although the findings of this study are
descriptive in nature, with one additional finding demonstrating significance regarding a
comparison of the opinions and attitudes of PBL faculty and non-PBL faculty on the
effectiveness of each respective method, there are specific limitations that need to be
discussed.

(1) **Sample.** The athletic training educators were randomly selected from a list of CAAHEP accredited athletic training educational programs representing all three types of athletic division programs: I., II., and III. It cannot be assumed that this sample represents all athletic training educators. First, educators who instruct in internship programs were excluded. There are many more internship programs than CAAHEP accredited athletic training curriculums, which would suggest that there are more educators currently in the internship setting. CAAHEP curriculum educators were chosen because the internship route will be eliminated in a few years, but the possible responses from internship educators cannot be ignored. Second, the respondents did not include the 13 programs from the original list of 37 programs because the program directors did not respond to the request for the names of their current educators. The responses of these educators may have altered the results of this study. Lastly, the subjects who did not return the survey (18%) may have also caused a change in the results of the study.

(2) **Survey Instrument.** The survey instrument was designed after a thorough review of the literature on PBL. Although each teaching method item presented a variety of types of PBL and traditional methods, respondents may not have identified the method they use based on the description given in the teaching method items. The ambiguity of the definition of PBL creates a limitation. Readers who use PBL may not have recognized its components as they were presented in several different method items. Also, the need to keep the survey short posed another limitation resulting in a limited number of teaching method options that respondents could choose.
(3) **Research Design.** The opinions and attitudes of educators about their methods were selected as the evaluative measure to assess the effectiveness of the identified teaching methods. Using teacher self-assessment can reveal biased opinions thus limiting the results of the study.

**Practical Implications**

The findings of this study have practical implications for athletic training education. Currently, athletic training educators are utilizing many different methods in addition to traditional teaching methods in the instruction of student athletic trainers. Educators are employing multiple variations of the PBL method. They are using student-centered techniques in addition to teacher-directed techniques, and they are incorporating case-based lessons as well. Educators are also using other innovative methods such as web-based discussions and video case-based discussions. These findings indicate that athletic training educators are exploring different educational teaching approaches to address the vast number of competencies outlined for national accreditation standards.

The finding that athletic training educators are using all of these different methods, traditional, PBL, and other innovative methods, also reveals that these methods are, at the least, feasible for athletic training education. The educators in this study that use these methods claim that the methods they employ are effective in addressing important educational outcomes in athletic training. All of the educators in this study have favorable opinions and attitudes regarding the effectiveness of their teaching methods. The fact that there was no difference between educators that use PBL methods and those educators that use other methods in response to the effectiveness of each respective method, it can be concluded that both types of methods are effective according
to faculty perceptions. With this in mind, athletic training educators who currently use traditional methods have other teaching method options, such as PBL, to select as an instructional strategy in the education of student athletic trainers.

**Future Research**

The descriptive nature of this study on the use of PBL in athletic training education provides a starting point for further research.

1. Identify use of PBL in graduate athletic training educational programs. It was indicated that PBL was more feasible at the graduate level.

2. Identify and evaluate current athletic training programs that use PBL in several of their courses in comparison to athletic training educational programs that use traditional methods. Comparisons can be made utilizing objective criteria such as the NATABOC certification exam.

3. Design, implement, and evaluate a simulated patient problem pack for an athletic training education unit or course. The Center for Professional Development at the Southern Illinois School of Medicine has a Problem Based Learning Module (PBLM) publishing program to make simulated patient packs available to interested programs.

4. Evaluate implementation issues of PBL, such as cost, faculty training, and total time commitment expected of faculty.

5. Assess student opinions and attitudes about PBL versus traditional teaching methods. Assess attitudes at the start of unit and at the end of unit to note change. Assess amount of time students spend in self-directed study during course.

**Conclusion**

Athletic training educators are using PBL as an instructional strategy in the
education of student athletic trainers. The majority of the educators surveyed in this study use a strong PBL method that is characterized by student-centered learning around real-life patient cases. The athletic training educators that use PBL believe PBL methods are effective in achieving outcomes such as an effective clinical reasoning ability, a sound knowledge base of the basic sciences, and adequate preparation for the national certification exam. The athletic training educators who use other teaching methods, such as the traditional teacher-directed lecture method, also believe that the methods they employ are effective. In general, teachers of athletic training are satisfied with the methods they are currently using in the instruction of student athletic trainers. This study offers educators accustomed to traditional methods or new educators an option of employing an alternative method, PBL, which has been shown to produce effective outcomes and to be enjoyable for both faculty and students.
REFERENCES


Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.


Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.


OTHER REFERENCES


This questionnaire is designed to identify instructional strategies currently being used by athletic training educators. The questionnaire is divided into three sections. Please follow the instructions given at the beginning of each section. Remember, all information will be kept confidential and remain anonymous.

Section I. Background Information
Instructions: Please complete the following section.

1. Name of Institution: _______________________________________
2-4. Check your highest degree held: Master's PhD Other___________
   Have you ever held a teacher certification credential? Yes No____
   If yes, in what area: _________________________________________
5. What is your official position?
   Tenured faculty ____ Non-tenured faculty ____ Staff ____ Other _____
6. What is your rank?
   Instructor ____ Assist. Prof. ____ Assoc. Prof. ____ Full Prof.____
7. Indicate the % of time out of your total time dedicated to the following job responsibilities.
   Athletic Coverage % Time _________
   Classroom Instruction % Time _________
   Other ____________ % Time _________
8. Including the present year, how many years have you instructed athletic training students? _________
9. How many courses and total credit hours of instruction do you typically teach in one year?
   Courses/year? _________ (semester/quarter system)
   Credit hours/year? _________ (semester/quarter system)
10. What athletic training courses have you taught in the past two years? (Indicate the average number of students in each course)

<table>
<thead>
<tr>
<th>Course Title/s</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______________</td>
<td>_________________</td>
</tr>
<tr>
<td>_______________</td>
<td>_________________</td>
</tr>
<tr>
<td>_______________</td>
<td>_________________</td>
</tr>
<tr>
<td>_______________</td>
<td>_________________</td>
</tr>
<tr>
<td>_______________</td>
<td>_________________</td>
</tr>
</tbody>
</table>

110
Section II.

Instructions: Please answer the following questions concerning the instructional methods you employ in the education of your athletic training students. Read through all of the different methods on the left once (highlighted terms call attention to different methods/techniques). Then read each question again and respond in the right column indicating how often you use each method in your approach to teaching in a typical week.

<table>
<thead>
<tr>
<th>Method</th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Teacher-directed lecture used to explain information, ideas, concepts, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Teacher-directed questioning to check student understanding of information, ideas, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Assignment of a case study prior to a teacher-directed lecture that highlights key information in the lecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Assignment of a case study after a teacher-directed lecture that reinforces lecture information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Teacher-directed lesson in which the teacher moderates the discussion in order to create dialogue and discussion about the material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Teacher-directed lecture that demonstrates strategy or sequence (eg. hypothetico-deductive reasoning)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Students explore a textbook or real-life case through open-ended discussion without the teacher recommending a particular method of inquiry.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
<p>| | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>18. <strong>Student-centered</strong> group discussion of <strong>textbook</strong> case studies in which students are given only a <strong>portion</strong> of the necessary information about the case (ill-structured problem, requires the search for additional info in its probable solution).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. <strong>Student-centered</strong> group discussion of <strong>textbook</strong> case studies in which students are given all of the necessary information about the case (complete).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. <strong>Student-centered</strong> group discussion of <strong>real-life injury case studies</strong> in which students are given only a <strong>portion</strong> of the necessary information about the case (ill-structured problem, requires the search for additional info in its probable solution).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. <strong>Student-centered</strong> group discussion of <strong>real-life injury case studies</strong> in which students are given all of the necessary information about the case (complete).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Assigned activities that require students to find and to use resources, beyond course materials (i.e. journals, electronic media, etc.) to solve athletic training problems.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Other Methods (Briefly explain):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Other Methods (Briefly explain):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
**Section III.** Please rate the following outcomes of your instruction (circle one response).

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

**Coursework leads to:**

25. Students' high interest and enthusiasm

26. Students' knowledge of anatomy, physiology and kinesiology

27. Students' understanding and ability to apply athletic training concepts to the clinical experience

28. Students' self-directed learning

29. Students' effective clinical reasoning ability

30. Students' preparation for the certification exam

**Coursework also leads to:**

31. Teacher's personal satisfaction

32. Overall value to students

Explanations and Qualifications:
Dear «FirstName» «LastName»:

I am currently pursuing my Ph.D. in Education: Curriculum and Instruction at the University of New Hampshire, while teaching full-time at Brooklyn College. My dissertation project is designed to investigate the instructional methods currently employed by athletic training faculty. Our profession has progressed in the area of education by developing new educational competencies and athletic training curriculum; however, there has been a lack of attention given to the instructional strategies used by athletic trainers. It is important to determine the different instructional methods and activities used by athletic training faculty as well as the faculty’s perception of their effectiveness. Your contribution will be very beneficial to the profession, especially to those who are new to the education arena.

Please complete the attached questionnaire and return it to me in the enclosed self-addressed stamped envelope by November 25, 1998. Instructions for the completion of the questionnaire are noted at the beginning of each section of the questionnaire. All questionnaires are anonymous and will be kept confidential. Your participation is, of course, voluntary.

I am quite aware of your time demands, and therefore appreciate your efforts in this project. If you have any questions concerning the questionnaire or if you would like a preliminary report of the analyses of these data, please contact me via e-mail (kerric@netmonger.net) or phone me at (718) 951-4125.

Thank you for your time,

Kerriann Catlaw, M.Ed., ATC
Assistant Professor
7, December 1998

Dear «FirstName» «LastName»:

This is simply a follow-up letter to insure that you have received a copy of my survey instrument. If you have and already returned the survey, thank you very much and please disregard this letter. If you did not have a chance to complete the survey as of yet, please take a moment to do so and return it to me at your earliest convenience. Your input as an athletic training educator is vital to my project. I enclosed an additional copy of the survey in case one was never received or if it was misplaced. Instructions for the completion of the survey are noted at the beginning of each section of the questionnaire. Again, all questionnaires are anonymous and will be kept confidential, and your participation is, of course, voluntary.

I appreciate you taking time to assist with my dissertation project. If you have any questions concerning the questionnaire or if you would like further information, please contact me via e-mail (kerric@netmonger.net) or at (718) 951-4125.

Thank you for your time,

Kerriann Catlaw, M.Ed., ATC
Assistant Professor
<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>Never 1 Fr.(%)</th>
<th>2 Fr.(%)</th>
<th>3 Fr.(%)</th>
<th>4 Fr.(%)</th>
<th>5 Fr.(%)</th>
<th>Always 6 Fr.(%)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>teacher-directed lecture</td>
<td>N/A</td>
<td>1(1.2)</td>
<td>4(4.8)</td>
<td>11(13.3)</td>
<td>38(45.8)</td>
<td>29(34.9)</td>
<td>5.08</td>
<td>.89</td>
</tr>
<tr>
<td>12</td>
<td>teacher-directed question</td>
<td>N/A</td>
<td>2(2.4)</td>
<td>10(12.0)</td>
<td>12(14.5)</td>
<td>38(45.8)</td>
<td>21(25.3)</td>
<td>4.80</td>
<td>1.03</td>
</tr>
<tr>
<td>13</td>
<td>case prior to lecture</td>
<td>25(30.1)</td>
<td>36(43.4)</td>
<td>10(12.0)</td>
<td>8(9.6)</td>
<td>3(3.6)</td>
<td>1(1.2)</td>
<td>2.17</td>
<td>1.15</td>
</tr>
<tr>
<td>14</td>
<td>case after lecture</td>
<td>21(25.3)</td>
<td>22(26.5)</td>
<td>14(16.9)</td>
<td>14(16.9)</td>
<td>10(12.0)</td>
<td>2(2.4)</td>
<td>2.71</td>
<td>1.44</td>
</tr>
<tr>
<td>15</td>
<td>teacher moderation</td>
<td>9(10.8)</td>
<td>13(15.7)</td>
<td>15(18.1)</td>
<td>23(27.7)</td>
<td>16(19.3)</td>
<td>7(8.4)</td>
<td>3.54</td>
<td>1.46</td>
</tr>
<tr>
<td>16</td>
<td>teach-dir demo of strat.</td>
<td>9(10.8)</td>
<td>7(8.4)</td>
<td>7(8.4)</td>
<td>16(19.3)</td>
<td>19(22.9)</td>
<td>23(27.7)</td>
<td>9(10.8)</td>
<td>3.81</td>
</tr>
<tr>
<td>17</td>
<td>stud.-cent; explore cases</td>
<td>29(34.9)</td>
<td>23(27.7)</td>
<td>17(20.5)</td>
<td>6(7.2)</td>
<td>7(8.4)</td>
<td>1(1.2)</td>
<td>2.30</td>
<td>1.31</td>
</tr>
<tr>
<td>18</td>
<td>stud.-cent; inc. text cases</td>
<td>32(38.6)</td>
<td>24(28.9)</td>
<td>10(12.0)</td>
<td>7(8.4)</td>
<td>7(8.4)</td>
<td>3(3.6)</td>
<td>2.30</td>
<td>1.45</td>
</tr>
<tr>
<td>19</td>
<td>stud.-cent; comp. text cs</td>
<td>36(43.4)</td>
<td>22(26.5)</td>
<td>12(14.5)</td>
<td>6(7.2)</td>
<td>6(7.2)</td>
<td>1(1.2)</td>
<td>2.12</td>
<td>1.31</td>
</tr>
<tr>
<td>20</td>
<td>stud.-cent; inc real case</td>
<td>23(27.7)</td>
<td>16(19.3)</td>
<td>17(20.5)</td>
<td>16(19.3)</td>
<td>7(8.4)</td>
<td>4(4.8)</td>
<td>2.76</td>
<td>1.50</td>
</tr>
<tr>
<td>21</td>
<td>stud.-cent; com real cs</td>
<td>19(22.9)</td>
<td>18(21.7)</td>
<td>20(24.1)</td>
<td>8(9.6)</td>
<td>11(13.3)</td>
<td>7(8.4)</td>
<td>2.94</td>
<td>1.60</td>
</tr>
<tr>
<td>22</td>
<td>self-directed study</td>
<td>4(4.8)</td>
<td>9(10.8)</td>
<td>5(6.0)</td>
<td>15(18.1)</td>
<td>31(37.3)</td>
<td>19(22.9)</td>
<td>4.41</td>
<td>1.51</td>
</tr>
</tbody>
</table>

Table D1: Teaching Method Item Statistics (n=83)
<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>SD</th>
<th>1 Fr.(%)</th>
<th>2 Fr.(%)</th>
<th>3 Fr.(%)</th>
<th>4 Fr.(%)</th>
<th>5 Fr.(%)</th>
<th>6 Fr.(%)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>student interest</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>knowledge acquisition</td>
<td>N/A</td>
<td>1(1.2)</td>
<td>13(15.7)</td>
<td>16(19.3)</td>
<td>28(33.7)</td>
<td>25(30.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>understand/apply know.</td>
<td>N/A</td>
<td>1(1.2)</td>
<td>5(6.0)</td>
<td>13(15.7)</td>
<td>35(42.2)</td>
<td>29(34.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>self-directed learning</td>
<td>N/A</td>
<td>6(7.2)</td>
<td>17(20.5)</td>
<td>28(33.7)</td>
<td>27(32.5)</td>
<td>5(6.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>clinical reasoning</td>
<td>N/A</td>
<td>3(3.6)</td>
<td>12(14.5)</td>
<td>23(27.7)</td>
<td>38(45.8)</td>
<td>7(8.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>prep. for cert. exam</td>
<td>N/A</td>
<td>1(1.2)</td>
<td>3(3.6)</td>
<td>6(7.2)</td>
<td>14(16.9)</td>
<td>38(45.8)</td>
<td>21(25.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>teacher’s satisfaction</td>
<td>N/A</td>
<td>8(9.6)</td>
<td>30(36.1)</td>
<td>29(34.9)</td>
<td>16(19.3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>overall value to students</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>