THE EFFECT OF PROBLEM-BASED LEARNING AS A TUTORING INTERVENTION IN ATHLETIC TRAINING EDUCATION: EXPLORING THE THEORY APPLICATION GAP IN THE BOARD OF CERTIFICATION, INC. TREATMENT AND REHABILITATION DOMAIN AT REGIONAL UNIVERSITY IN TEXAS

A Record of Study

by

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ABSTRACT

The purpose of this study was to explore the effects of problem-based learning (PBL) as a tutoring intervention in narrowing the theory application gap within the treatment and rehabilitation domain of Regional Universities athletic training education program (ATE). Research indicates there are theory application gaps between didactic and practical applications in nursing, physical therapy, athletic training, and teacher education programs. This theory application gap exists when a transfer of knowledge breakdown occurs in the classroom and clinical practice integration. Students at Regional University in Texas have scored well below the national average in the treatment and rehabilitation domain of the Board of Certification, Inc. national certification examination.

Athletic students within the RU ATE volunteered for participation in the study and provided the sample of convenience (N=15). The sample size consisted of student cohorts from each academic level within the ATE: Level-I (N=5), Level-II (N=5), and Level-III (N=5). Students participated in the study for five-weeks during the spring of 2013. Students received an orientation to PBL during the first week followed by the PBL tutoring intervention in the subsequent weeks.

This study utilized a convergent parallel mixed methods design as the methodological framework. The Elizondo-Montemayor Criterion Reference (EMCR) self-assessment for PBL was utilized as the pre and posttest quantitative tool.

Descriptive analysis was performed on the EMCR followed by the Kruskal-Wallis statistical analysis to and a post-hoc Mann-Whitney U analysis.

Qualitative data was collected using the transcripts from focus groups and student reflection journals. A constant comparative method of analysis was used to review data from the focus groups and reflection journals. The EMCR self-assessment PBL objectives guided the thematic coding process. Through the constant comparative method of analysis, sub-themes emerged in both the focus groups and reflection journals.

The results of the study indicate a statistical significance in the pre-posttest in the PBL objects of application of knowledge, clinical reasoning, and self-directed learning. However, the average self-directed learning EMCR score rated the academic levels as “poor”. Qualitative results corroborate the self-directed learning quantitative findings, students also perceived the theory application gap within ATE as one that hinders learning.

DEDICATION

For My Dad.

Darrell Jon Gililland Sr.

August 30, 1947 – May 1, 2015

I love the Lord because he hears my voice, and my prayer for mercy. Because he bends down to listen, I will pray as long as I have breath! Death wrapped its ropes around me; the terrors of the grave overtook me. I saw only trouble and sorrow. Then I called on the name of the Lord: “Please, Lord, save me!” How kind the Lord is! How good he is! So merciful, this God of ours! The Lord protects those of childlike faith; I was facing death, and he saved me. Let my soul be at rest again, for the Lord has been good to me. He has saved me from death, my eyes from tears, my feet from stumbling. And so I walk in the Lord’s presence as I live her on earth! I believed in you, so I said, “I am deeply trouble, Lord.” In my anxiety I cried out to you, “These people are all liars!” What can I offer the Lord for all he has done for me? I will lift up the cup of salvation and praise the Lord’s name for saving me. I will keep my promises to the Lord in the presence of all his people. The Lord care deeply when his loved ones die. O Lord, I am your servant; yes, I am your servant, born into your household; you have freed me from my chains. I will offer you a sacrifice of thanksgiving and call on the name of the Lord. I will fulfill my vows to the Lord in the presence of all his people-in the house of the Lord in the heart of Jerusalem. Praise the Lord!

Psalm 116:1-19

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NOMENCLATURE

AT	Athletic Training
ATC	Athletic Trainer, Certified (also referred to as Certified Athletic Trainer)
ATE	Athletic Training Education
BOC, Inc.	Board of Certification, Inc.
CAAHEP	Committee on Accreditation of Allied Health Education Programs
CAATE	Committee on Accreditation of Athletic Training Education Programs
EMCR	Elizondo-Montemayor Criterion Reference
JRC-AT	Joint Review Committee on Athletic Training
NATA	National Athletic Trainers' Association
PBL	Problem-Based Learning
RU	Regional University
TR	Treatment/Rehabilitation Domain

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CHAPTER I

INTRODUCTION

Background

Athletic Training is an allied health care profession providing medical services to countless age groups in a variety of practice settings. Athletic Trainers practice under the supervision of a physician, as directed by the various state licensure statutes. Additionally athletic traininers are highly skilled medical practitioners specializing in the prevention, diagnosis, and intervention of emergency, acute, and chronic medical conditions (NATA, 2012). An Athletic Training Education (ATE) curriculum uses a competency-based approach for the mastery of didactic and clinical skills competencies within the Athletic Training (AT) scope of practice. The AT curricular model parallels other allied health and medical fields, such as Physical Therapy (PT), Occupational Therapy (OT), and Nursing. However, research on ATE curriculum and instruction is not as prevalent as it is in these professions above (Turocy, 2002 and Gillette, 2011).

ATE has been in a constant state of transformation over the past 20 years. An unintended consequence of this transformation has been the lack of significant curriculum and instruction research within ATE as compared to other allied health professions. In 2002, Turocy challenged the ATE population to increase the amount of research conducted within AT curriculum and instruction. This call from Turocy indicated a need for current research within ATE curricula, determining how ATE aligns with educational and instructional theory (Turocy, 2002 and Gillette, 2011).

Professional educators of all disciplines should have an understanding of educational theory and practice. Professional programs (PT, OT, Nursing, Teacher Education, Speech Communication and Language Disorders) begin with practice theory and progress to clinical practice application. Clinical practice integration occurs in field experiences, student teaching, or professional internships (Carr & Drummond, 2002, Nasypany, 2005, Baxter 2007, Carlson, 2010). AT is no different in this regard, as students follow the same pedagogical and practical (clinical) application timeline. In these examples, the educational process must address the effectiveness of curriculum and instruction on the student's ability to transfer theory into practice. If this process creates a gap in the theory to practice paradigm, then a theory-application gap occurs (Carr & Drummond, 2002, Baxter, 2007, Carlson, 2010; Streveler, 2013). Applying theory and learning skills in a variety of clinical field experience settings can contribute to the difficulties in preventing the theory-application gap in AT education (Carr & Drummond, 2002). Nasypany (2005) noted his concerns with AT education to include clinical preceptor competency and preparedness, an understanding of educational theory/practice and an overall all desire to teach students within the clinical education setting. AT educators and clinical preceptors are competent clinical practitioners; however many are weak in the areas of pedagogy and may have never received pedagogical training. This study examined a tutoring intervention using problem-based learning (PBL) as a tutoring intervention to narrow the theory application gap within AT clinical education; establishing the study within curriculum and instruction practice standards.

Research performed by Singer and Moscovici (2008) examined how teaching and learning cycles happen within the constructivist theory and the approach for teaching strategies. Singer and Moscovici (2008) note new roles have developed for learners, teachers, and classroom settings within the schools of the United States and Europe. Learners now are autonomous thinkers, instead of the passive beneficiaries of information from a teacher. No longer is the teacher categorized as the knowledgeable authority, lecturing and instructing, but as a facilitator of learning for students. Lastly, the classroom setting has been transformed into an area designed to develop competencies, rather than to develop factual knowledge (Singer & Moscovici, 2007).

Singer and Moscovici (2008) also found problem solving to be a common outcome desired within the learning environment. The area of science curriculum development noted the use of the 5E's --Engage, Explore, Explain, Elaborate, and Evaluate-- to solve problems. The mathematic curriculum focused on understanding, devising a plan, carrying out the plan, and looking back. Moreover, mathematics engaged learners with the basic analysis, exploration, and verification process. The interdisciplinary curriculum example was from the Australian Planning Model. This model begins with a learning "cue" followed by five stages. These are input (provided by teacher), exploration, reshaping, presentation, and reflection (Singer & Moscovici, 2008). This review of Singer & Moscovici (2008) demonstrates how these distinctly different areas engage the learner and provide opportunities for the transfer of learning. Learning is then transferred to their content areas, using the constructivist theory approach within instructional strategies.

The Theory Application Gap

Professional preparatory programs often experience what Allen and Wright (2013) calls a "huge disparity between the types of skills and knowledge taught in pre-service programs and the realities of workplace practice" (p. 136). This disparity can lead to a theory-practice gap also called the theory application gap. The theory application gap exists when a breakdown occurs between the classroom (theory) and clinical practice (application) integration. This phenomenon is well documented in teacher education programs and nursing education, as noted in research conducted by Baxter, (2007), Streveler, (2013), and Allen & Write (20143). Allen & Wright (2014), reported teacher education programs have acknowledged the theory application gap regarding pre-service teachers practica. Allen and Wright's work notes pre-service teachers experienced many of the same disparities as allied health professionals when it came to the application of educational theory to the practicum course. Baxter (2007) noted nursing students face two areas of concern when dealing with the theory application gap. First, nursing students face the problem of a "reality shock" when placed in a clinical setting where theory learned in class is not practiced in the real world. Second, the application of evidence-based practice is less likely to occur in the clinical education setting if the professional clinician responsible for supervising the student is not practicing evidence-based medicine (Baxter, 2007). Streveler (2013) conducted the only study of student perceptions of the theory application gap in ATE. Streveler noted ATE students do perceive a gap between theory and practice and tend to rely more on the clinical setting where the "real" practice is taking place. This research

by Streveler was the first major AT study specifically evaluating the theory application gap within ATE, resulting in parallel results with other allied health professions.

Statement of the Problem

Employers of AT graduates suggest entry-level professionals are knowledgeable but lack the clinical skills necessary to be successful practitioners. Furthermore, employers note a lack of effective interpersonal communication, independent decision-making, work initiative, confidence, and the ability to learn from past mistakes (Carr, 2012). These characteristics suggest a gap between classroom learning and clinical practice, illustrating the theory-application gap. Dodge, Mitchell & Mensch (2009) discovered professional assimilation is needed to retain students and produce competent entry-level practitioners to avoid the lack of competence as noted by Carr (2012). Professional assimilation is the process by which a learner is actively engaged in professional practice standards, whether in the classroom or clinical setting, in preparation for a career in a professional field. Additionally professional assimilation allows the learner to engage in professional activities in a controlled environment such as patient evaluation, patient care, interdisciplinary communication, and professional development. Dodge, Mitchell, and Mensch (2009) contended that motivation was the key to encouraging students to pursue a career in athletic training by engaging them in meaningful educational experiences. The experience AT students have within the AT education program must center on clinical proficiency where clinical skills learned in the classroom and can be transferred into practice, working with real people and real problems.

Another issue facing ATE is the effectiveness of clinical education. Clinical education is the "practice of assisting a student to acquire the required knowledge, skills, and attitudes in practice settings to meet the standards as defined by a professional accrediting board" (Radtke, 2008). Concerns regarding clinical education included clinical preceptor competency, preparedness, and the ability to assess clinical competencies. Additionally, Nasypany (2005) express apprehension toward the AT student's experience. These concerns are whether the student gains the necessary education/practical experience within the clinical education model to enter the profession as a competent entry-level practitioner. The research above may lend to assessing the problem at Regional University

In the years between 2006-2011, AT students at Regional University scored 61% (out of 100%) in the Treatment and Rehabilitation (TR) domain of the Board of Certification Inc. (BOC) examination (BOC, Inc. 2006-2011). These scores are consistent with the national average of test takers during the same period (2006-2011), where the national average was just four points higher at 65% (BOC, Inc. 2006-2011). While theses scores indicate poor performance in the TR domain, students taking the BOC, Inc. examination can score well below average in one domain and still be able to pass the national certification test by passing the remaining four domains. The above statistical information from Regional University indicates the RU entry-level professional is lacking the necessary knowledge and skills to practice effectively in the TR domain of athletic training.

The Certified Athletic Trainer

The Certified Athletic Trainer is recognized by the American Medical Association as an allied health professional, educated in the areas of prevention, diagnosis, and intervention of emergency, acute and chronic medical conditions (BOC, 2011). The Board of Certification, Inc. (BOC) is the national certifying agency for athletic trainers in the United States, providing the Certified Athletic Trainer (ATC) credential. Earning the ATC credential is the goal of the athletic training student and is achieved by fulfilling the educational standards within the five BOC Inc. domains of athletic training and the National Athletic Trainer's' Association Educational Competencies. Athletic training students are eligible to take the BOC national certification exam by earning an entry-level bachelor or master's degree in athletic training. The Commission on Accreditation of Athletic Training Education (CAATE) is responsible for accrediting institutions with AT Education (ATE) programs. The BOC has identified five domains specific to the practice of athletic training at the entry-level position. These domains, coupled with the NATA educational competencies, provide the framework for the ATE curriculum. A caveat to note is that critical thinking skill acquisition is not addressed as a competency within the BOC domains of athletic training and the NATA educational competencies. Critical thinking skill acquisition is essential for the problem-solving, decision-making process, knowledge and skills, design, implementation of plans, and communication that is required in many of the AT educational competencies. The development and application of critical thinking skills are implied actions by the learner in ATE. German (2008) noted critical thinking skills

were *acknowledged (italics added)* by the NATA Education Council as a means to integrate knowledge and skills; however, there is no formal critical thinking skill acquisition competency. Furthermore, the uses of the upper level of Bloom's taxonomy (i.e., analysis, synthesize, apply), within the competencies illustrate the need for critical thinking (German 2008). Additionally, critical thinking skills are essential for professional assimilation and practice (German, 2008). Listed below is a representation of how critical thinking skills integration takes place in the five BOC domains of athletic training education.

1.) Injury/Illness Prevention and Wellness Protection

- Provides patient education and risk management practices.
- Knowledge & Skills: Applying-Communication, Assessment, Research

2.) Clinical Evaluation and Diagnosis

- Creates a standard of evaluation practices and differentiation of clinical decisions.
- Knowledge & Skills: Applying-Interpretation and Evaluation

3.) Immediate and Emergency Care

- Conducts standard of care practices based on current emergent trends.
- Knowledge & Skills: Analyzing and Application

4.) Treatment and Rehabilitation

- Creates treatment and rehabilitations programs for the return to normal activity.
- Knowledge & Skills: Evaluate, Compare, Differentiate, Interpret,

Synthesize, Application

5.) Organizational and Professional Health and Well-Being

- Maintains professional and organizational standards through appropriate practice standards.
- Knowledge & Skills: Design, Implement, Develop, Communicate

Background of Athletic Training Education

In 1959 the National Athletic Trainers' Association (NATA) recognized the first approved athletic training education curriculum. The early curriculum included prerequisites for physical therapy, with selected courses from biology, psychology, and physical education (Perrin, 2007). During this period there were two paths to NATA certification, the NATA approved curriculum and internship programs.

The approved curriculum programs provided a rich cognitive and didactic approach to athletic training coupled with field based experiences. In contrast, the internship programs provided extensive clinical practice and field based experience as an apprentice to a Certified Athletic Trainer. Additionally the internship program had no curricular component and met minimal course content requirements in athletic training. During the 1980s, the NATA transitioned from the approved curriculum format to a formal curriculum regulation. The Professional Education Committee of the NATA provided oversite for the curriculum programs while at the same time continuing the approved internship route to certification (Perrin, 2007). These guidelines prompted the initial stages of the competency-based education model. By 1983, the first competencies in athletic training were published (Perrin, 2007). The reform movement of the 1980s

began to redefine the profession of athletic training. In 1990, the profession of athletic training gained recognition from the American Medical Association as an allied health profession (Perrin, 2007).

The creation of the Joint Review Committee in Athletic Training (JRC-AT) in 1990 established governance to evaluate athletic training educational programs (ATEP). The foundational principles of the JRC-AT were to utilize the 1983 competencies in athletic training and to develop a set of standards and guidelines for curriculum accreditation. In 1998, the JRC-AT recommended all NATA programs formally move to Athletic Training degree-granting status (bachelor's level) and accreditation by the Committee on Health Education and Allied Health Programs (CAHEEP). In 2004, after more than 50 years, the NATA discontinued the internship program path to certification. A student who was interested in pursuing AT as a profession had to enroll in an accredited ATE curriculum program (Perrin, 2007).

Athletic training education programs. In higher education, athletic training education programs (ATE) use the combination of theory, laboratory, and field-based clinical experiences to introduce and master the competencies required to be a candidate for the BOC examination.

Each ATE program must meet the standards and guidelines set forth by the Commission on Accreditation of Athletic Training Education (CAATE). Accreditation of the ATE program allows the AT student to complete an entry-level degree in AT. The entry-level degree is required to take the BOC examination, where he or she can earn the Athletic Trainer Certified (ATC) credential. Currently, entry-level degrees are offered at the bachelor's and master's level (BOC, Inc., 2011, CAATE, 2012, NATA, 2012). ATE programs must adhere to the NATA Education Competencies, where CAATE accreditation standards direct the NATA competencies to reflect the BOC, Inc. educational domains. Each organization aims to meet the standards for eligibility to take the BOC, Inc. national certification examination. Exclusively the organizations have the goal of developing qualified athletic trainers. However, each organization maintains its autonomy for checks and balances of the other. Figure 1 demonstrates the different roles each organization plays in an ATE program.

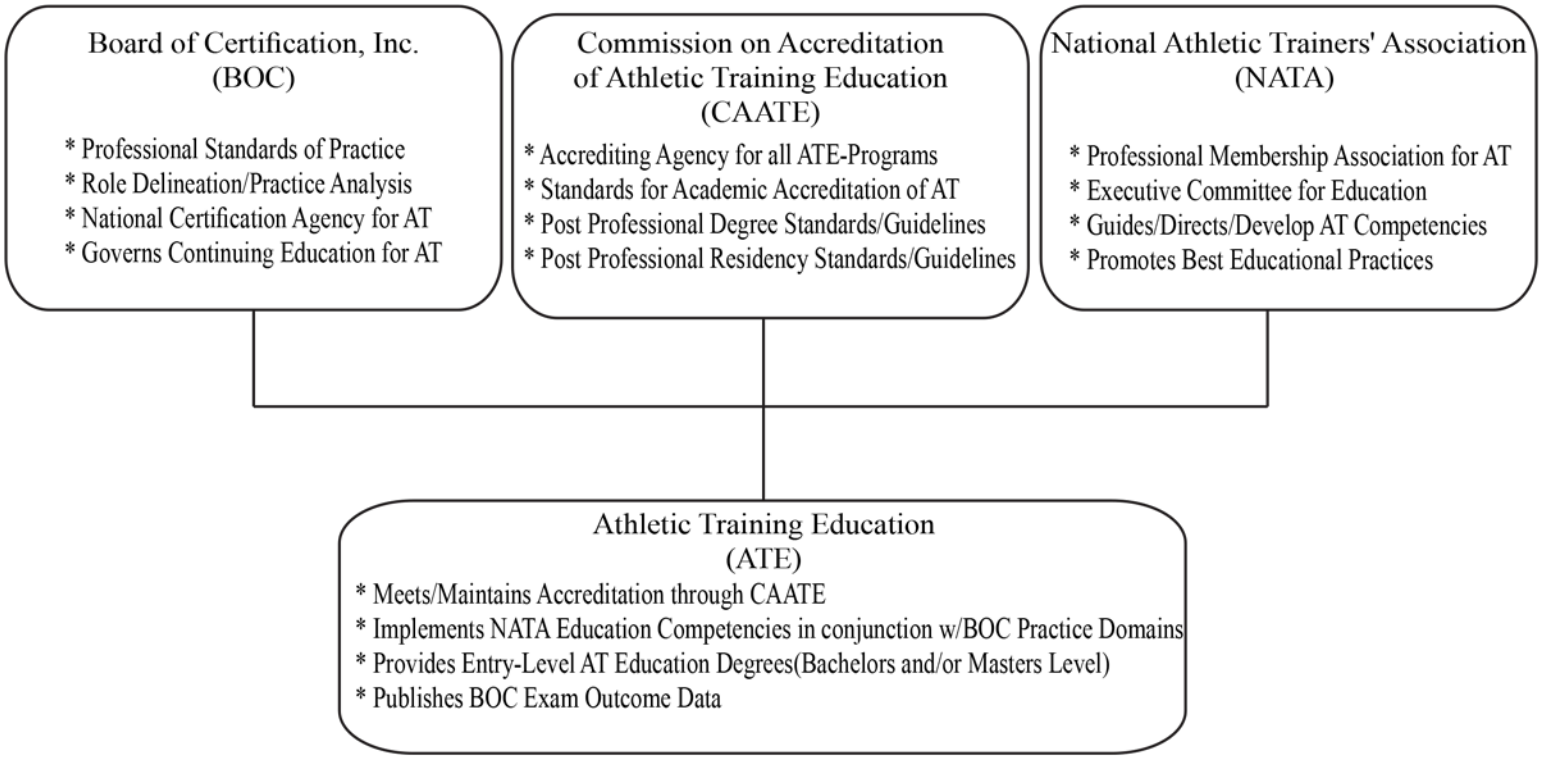

Figure 1 Athletic Training Governing Bodies
Note. This figure demonstrates the various governing bodies in athletic training and how each affect athletic training education.

Constructivist Learning Theory and Athletic Training Education

Constructivism is an educational theory in which learning is processed into meaning from previous and concurrent learning experiences (Levin, 2010). Learning is constructed from old and new knowledge based on the learner's personal experience. vonGlaserfeld (cited in Larochell, Bednarz, & Garrison, 1998) identifies constructivism as the use of knowledge as a tool within the experience of the learning environment. The learner must equip him or herself to meet the challenges of the learning environment, whether practical or theoretical. Constructivism theorizes that the learner is capable of gaining depth and complexity of knowledge by way of constructing learning options that are useful to the individual (Larochell, Bednarz, & Garrison, 1998). The constructivist theory employs different teaching and learning theories as the medium in which individuals construct meaningful knowledge (Figure 2).

The teaching and learning theories that fall under the umbrella of the constructivist theory are many. This study will review how the foundation of constructivism is applied using the instructional strategy of problem-based learning. PBL's approach to learning is evident in the foundational theory of constructivism and can combine with other learning theories (i.e. experiential, discovery, service learning) to construct new knowledge and application from a problem. Constructivists create real-world applications and/or difficult conditions within the context of poorly developed problems or situations (Duffy & Jonassen, 1992).

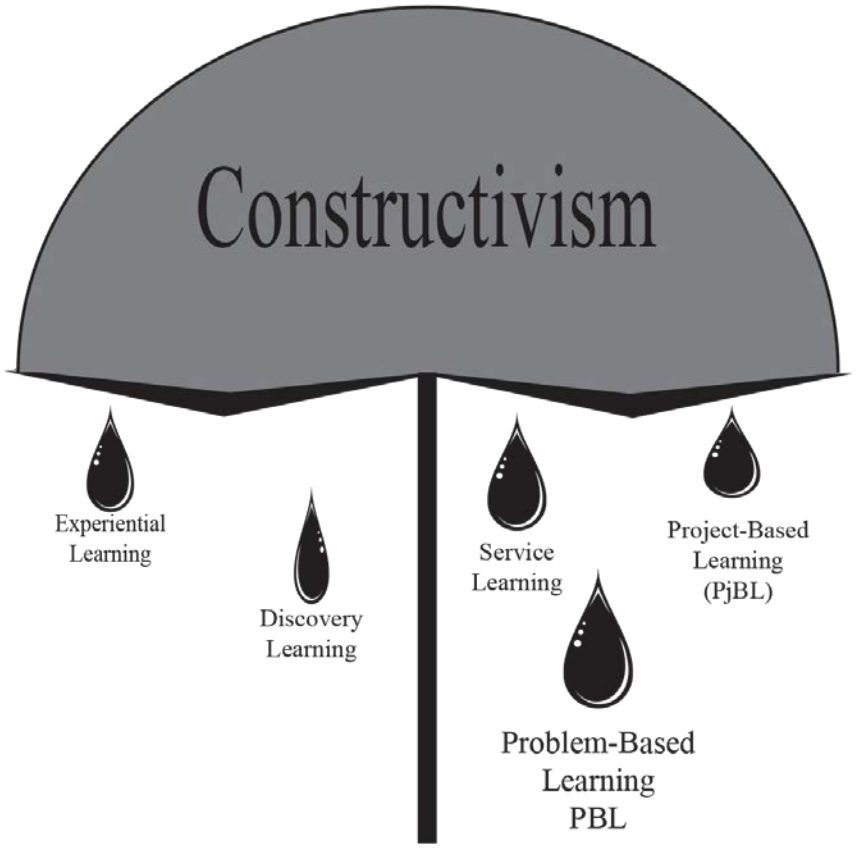

Figure 2 Constructivism Umbrella

Note. Illustration of the various teaching and learning theories grounded in constructivism

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Engaging learners in constructivism allows individuals to gain knowledge through a variety of methods, including hands-on learning, discovery, and personal connection (Hendry, Fromer, & Walker, 1999). Educational theorists Bruner, Dewey, Piaget, and Vygotsky theorized that the constructivist approach to learning enhances critical thinking, problem solving, and transfer of knowledge through connections. (This will be discussed in greater detail in Chapter II.) The various avenues in which the constructivist theory is used to engage the learner throughout the learning process, to be discussed in this study, are experiential learning, discovery learning, service learning, and problem based-learning. A brief description of each follows with a more in-depth discussion of the learning theories presented in Chapter II.

Constructivist Learning Theories

Experiential learning. Experiential learning relies on learning experience (both positive and negative) to develop connections with new experiences, constructing greater meaning and understanding. Dewey states, "It is not enough that certain materials and method/s have proved effective with other individuals at other times. There must be a reason for thinking that they will function in generating an experience that has educative quality with particular individuals at a particular time," (p. 46). Dewey theorized that education was about the experiences the learner engaged in during his or her lifetime. Experiential learning is a key component of the education of AT students. During the course of the AT experience, the clinical preceptor should work at developing a positive educational experience.

Discovery learning. Discovery learning, theorized by Bruner in the 1960s, provides a learning environment for facilitator-led discovery; individual-guided discovery, case-based learning, as well as problem-based learning (Alfieri, 2010). Developing a discovery learning application should engage and enhance the educational process. Alfieri (2010) suggests using at least one of the following approaches to the design of discovery learning: Scaffolding, reflection/feedback, and/or examples. Discovery learning has many overlapping characteristics with other learning theories as it supports the individual learner and promotes self-directed learning.

Service based learning. Historically, service based learning traces its heritage back to Harvard College in 1636. One of the stated missions of Harvard was to educate and train the clergy to minister to the needs of the community (Price, 2008). Hughes, Steinhorn, Davis, Beckrest, Boyd, and Cashen (2012) identify service learning as a teaching and learning strategy whereby learners actively take part in a community service project while reflecting on the teachings from the classroom about social justice issues within the community. Service learning is not just a strategy used within education, sociology, or religion curricula. Allied-health and medical school curriculums also implement service-based learning into the development of health care professionals (Hunt, Bonham, & Jones, 2011). Service-based learning constructs are meaning to the issues facing communities.

Problem-based learning. Problem-Based Learning (PBL) was first introduced to the medical community during the 1950s and 1960s at McMasters University in Hamilton, Ontario, Canada (McLoda, 1996; Catlaw, 1999; Dochy et. al, 2003; and

Gillette, 2011). Howard Barrows is credited with the development of PBL. Barrows was instrumental in creating the instructional method to engage the learner in active learning rather than the traditional medical school lecture and rote memorization (McLoda, 1996; Catlaw, 1999; and Dochy et. al, 2003). Barrows believed that learning was the result of a working process towards the understanding of a problem (Barrows & Tamblyn, 1980). Barrows (1986) outlines the educational objectives of PBL as:

- Structuring of knowledge for use in clinical education and practice
- Developing an effective clinical reasoning process
- Developing self-directed learning skills
- Increasing motivation for learning

Through these educational objectives, students engage in problem solving, critical thinking, discovery learning, and increased awareness. The PBL objectives are found in the various field of study, specific in this case to athletic training education (Barrows, 1994). PBL relates well to the theories of constructivism to provide learners with tools necessary to link theory and practice together (Hendry, 2006).

Problem-Based Learning is an established learning theory where new knowledge is "constructed" upon prior knowledge and experiences. The constructivist theory provides the foundation from which PBL is developed to optimize student engagement (Hendry, Frommer, & Walker, 1999). PBL is a combination of theory (idea), transfer of learning (process), and application (action) of knowledge. PBL relies on real-world problems to bridge the theory application gap (Figure 3).

AT curriculum development relies on the application of knowledge and the transfer of learning in the clinical practice setting. PBL uses a real-world problem and is the avenue by which knowledge acquiritions occurs, and critical-thinking skills are developed. New learning takes place through problem solving, collaboration, discovery and self-directed learning (McLoda, 1996; Catlaw, 1999; Barrows, 1994; Dochy, Segers, Van den Bossche, and Gijbels, 2003). PBL has also been misidentified as Project-Based Learning (PjBL). While the two instructional strategies are very similar in nature, there are distinct differences. PBL's intent is to have the learners work collaboratively to solve a real world ill-structured problem through the use of investigation, problem-solving techniques and critical thinking. The solution to the problem is not a creation of a product (Barrows & Tamblyn, 1980). Whereas PjBL has the learners, work collaboratively to create a product, presentation or performance (Johnson & Dewlaski, 2013). Figure 4 illustrates the similarities and differences between PBL and PjBL.

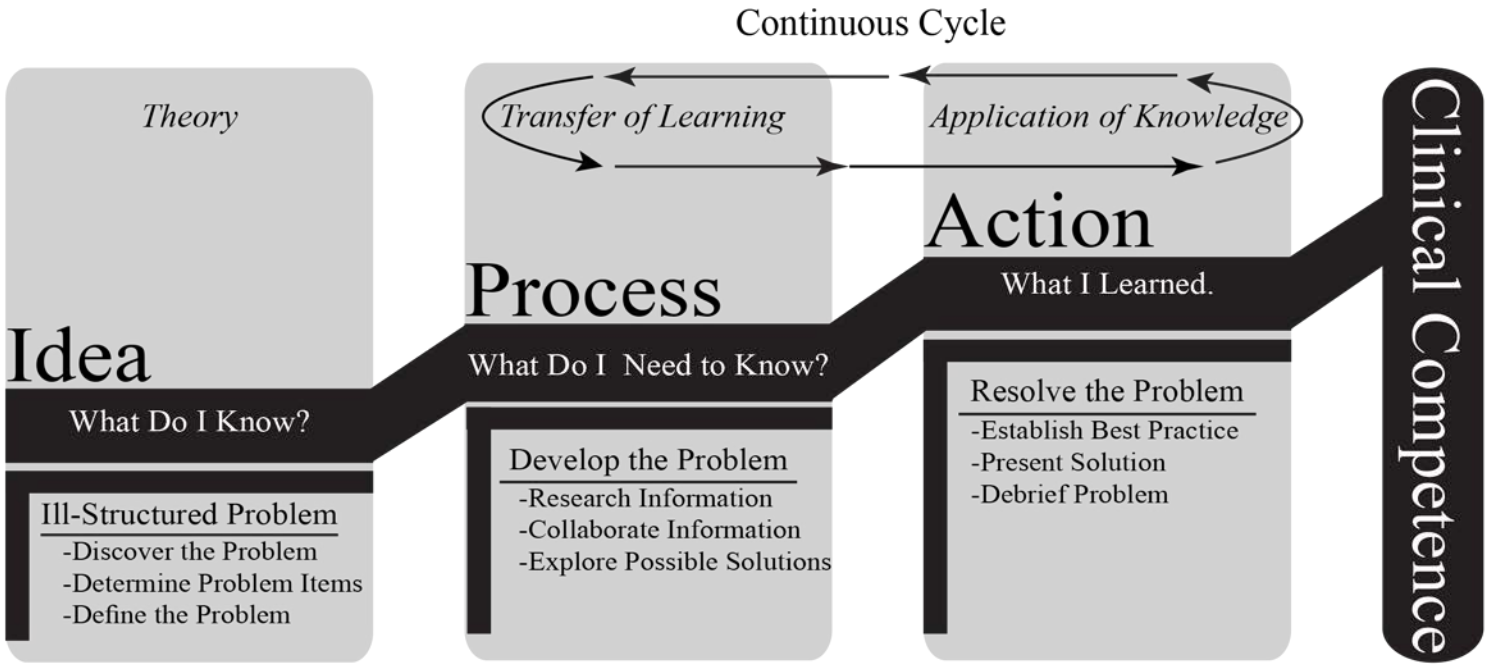


Figure 3 The PBL Process

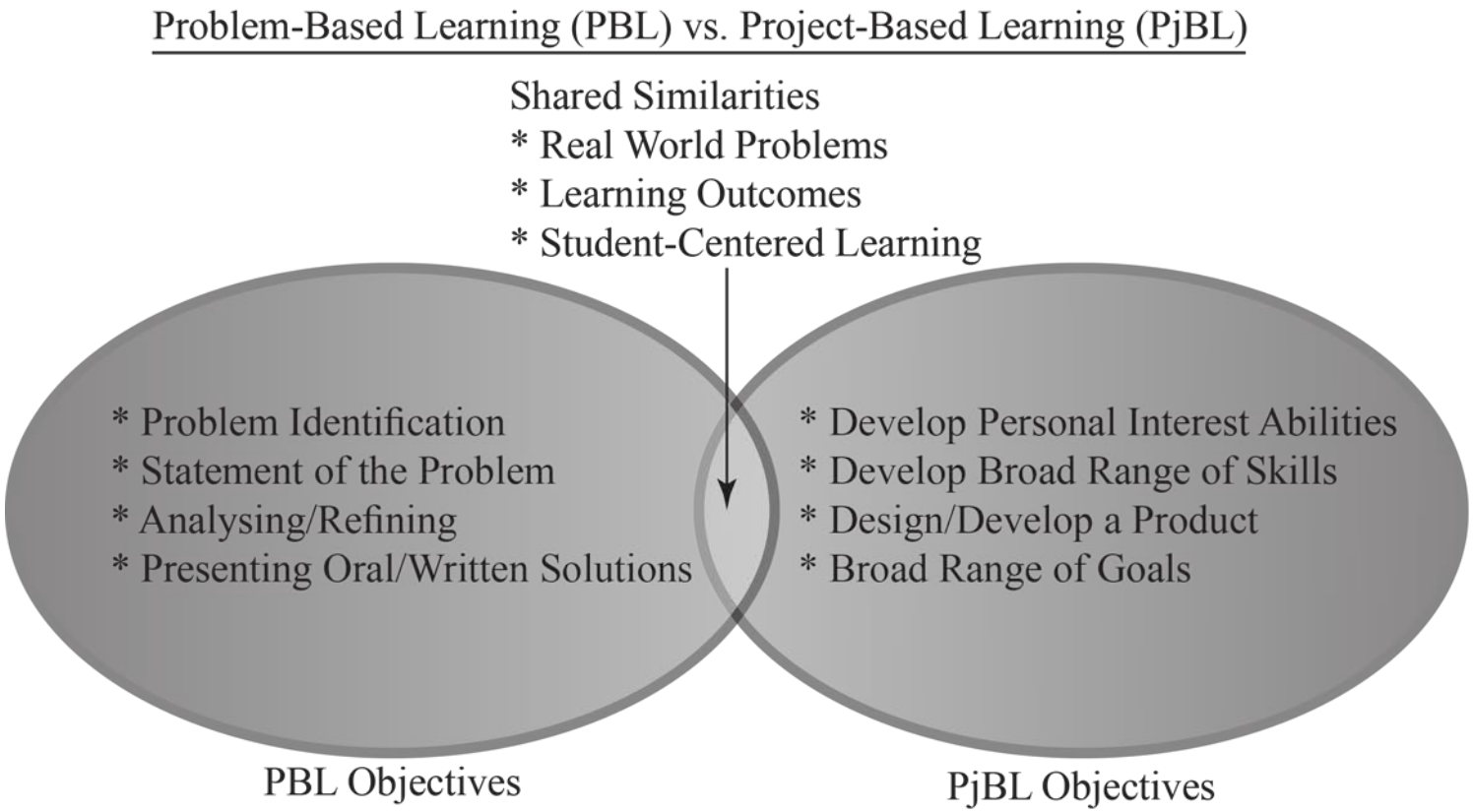


Figure 4 PBL vs. PjBL
Note: Problem-Based Learning and Project-Based Learning are distinctly different yet share similarities**.**

Purpose of the Study

The purpose of this mixed-method action research was to determine if a tutoring intervention using the PBL instructional strategy narrows the theory application gap between didactic and clinical education in AT. It was hypothesized that a tutoring intervention using PBL would create a connection between didactic and clinical education experiences for students while providing real-world practice in successfully caring for their patients (Smith-Goodwin & Wimer, 2010).

This mixed-methods study uses the convergent parallel design to determine the effects of a tutoring intervention using PBL on narrowing the theory application gap within the BOC, Inc. treatment and rehabilitation domain in athletic training education. Test subjects were fifteen students in the CAATE accredited ATE program at Regional University (RU) in Texas. Students participating in this study were randomly selected from the three levels of the ATEP in the spring of 2013. Students are classified as Level-I (first year), Level-II (second year), and Level-III (third year). ATTR Field Experiences in Athletic Training Courses meet formally for one hour per week, with an additional 20+ hours assigned to clinical, educational sites. Students engaged in the active transfer of learning and application of knowledge during clincal field experiences. Students participating in this study consisted of five Level-I, five Level-II, and five Level-III students who were in good academic standing with the university and the ATE program.

Research Questions

This mixed-methods study sought to answer the central question: Does a tutoring intervention, using the PBL instructional theory, narrow the theory application gap within the BOC, Inc. treatment and rehabilitation domain in an undergraduate athletic training education program at Regional University in Texas? Additional questions are:

Q1: Does a tutoring intervention using the PBL instructional theory provide RU students in the ATE Program the knowledge and skills necessary to apply theoretical information to practical applications?

Q2: How does PBL in the ATE program change the content engagement practices of RU students within a formal tutoring intervention?

Q3: How do students rate themselves on a pre and post self-assessment in a PBL intervention?

Q4: How does a PBL intervention in the ATE program change the collaborative exchange among students within the classroom and clinical field experiences settings?

Significance of the Study

The athletic training student must critically analyze problematic situations occurring while creating a patient-centered plan (Walker, 2005; Walker, 2012; Yang, 2012). Critical thinking skills are necessary while developing patient-centered treatment and rehabilitative programs (Dochy, Segers, Van den Bossche, and Gijbels, 2003; German, 2008; Walker, 2005 and Walker, 2012). Currently, students at RU participate in didactic courses taught using traditional lecture methodology and clinical field

experience courses using the practical application without any structured instructional strategy. This research may have impact in the following four (4) ways:

First, it will add to the body of research on AT education. Turocy (2002) outlined various areas of significance that should be explored and studied within ATEs such as learning, facilitating critical thinking, and instructional methods. In this study, the researcher examines a tutoring intervention using the PBL instructional strategy within the clinical education course component. This study will raise awareness of student learning perceptions as they engage in active problem-solving interventions and learn the skills necessary to implement effective treatment and rehabilitative measures.

Second it will look at a way to solve the problems raised by Carr's (2012) study on employer and employee reactions to entry-level practice outcomes of recent ATE program graduates. Carr (2012) noted that employers were concerned about professional assimilation in interpersonal communication, decision-making, initiative, confidence, ability to learn from mistakes, and administrative tasks (Carr, 2012). This study indicates ATE students need to improve in these areas of concern. Unprepared entry-level AT professionals may lack the clinical competencies to help prevent and or treat potentially devastating injuries. In the worst case scenario, an ill prepared entry-level AT practitioner could cost a patient his or her life. PBL is an instructional strategy that enables students to overcome the problem noted by Carr (2012).

Third, this study can assist in offering strategies for further PBL research and implementation of the ATE program at RU and other universities with similar AT programs. Through the results of this study, recommendations will be made to the

Regional University ATE program director on how to improve instructional delivery within the classroom. RU relies heavily on lecture-based instruction in didactic course work and practical experience in clinical coursework; this study will provide additional insight to create curricular changes in both the didactic and clinical education models.

Lastly, there is a pedagogical benefit. The clinical education model of athletic training education can be difficult for instructors and students. Students must take control of their learning in the classroom and within the clinical education setting. In the same regard, the athletic training educator must learn to be an academic and clinical leader. Preparing athletic training educators in the discipline of formal instructional strategies can be difficult, as many do not have a background in educational instruction. The impact goal of this study is to employ the PBL model of instruction as a valuable option for the future development of didactic and clinical education in athletic training education at RU and other universities.

CHAPTER II

REVIEW OF LITERATURE

Using problem-based learning (PBL) as the central learning theory the researcher's intent was to determine if a tutoring intervention is viable for narrowing the theory application gap. The theory application gap exists between the didactic and clinical education components of athletic training education at Regional University (RU). This review of literature focuses on four main areas: 1.) The historical perspective of athletic training education reform and the Regional University athletic training education (ATE) curriculum, 2.) The theory application gap as the guiding theoretical framework for this study. This section also includes a discussion on transfer of learning and application of knowledge. 3) Discussion of the constructivist theory as it relates to instructional theory within PBL. 4) Literature supporting the practice of PBL as an effective tutoring intervention for narrowing the theory application gap will conclude Chapter II. The overarching question of this study is: Does a tutoring intervention using PBL narrow the theory application gap within the BOC, Inc. treatment and rehabilitation domain in an undergraduate athletic training education program at Regional University in Texas?

Historical Perspective on Athletic Training Education and Educational Reform

In 1959, NATA recognized the first athletic training education curriculum (Catlaw, 1999). Beginning in the early 1960s and continuing through December 2003, athletic training education consisted of two routes for students to become eligible to gain national certification to be an athletic trainer. These two paths were the National Athletic

Trainers' Association (NATA) approved curriculum programs and the approved internship/apprenticeship program (Perrin, 2007). The NATA-approved curriculum programs provided a rich cognitive-based approach to athletic training education (ATE) combined with clinical experiences. In contrast, the NATA-approved internship programs delivered extensive clinical experience through an apprenticeship model under the direction of a Certified Athletic Trainer (ATC). The internship programs were required to meet minimal curricular standards versus the approved curriculum programs. These minimal curricular standards consisted of courses from biological sciences, physical education and specific courses in athletic training (Perrin, 2007). The early curriculum model paralleled the prerequisites used for physical therapy school admissions, as well as selected courses in biology, psychology, and physical education (Perrin, 2007). After establishing a governing body a decade later in 1969, the NATA approved the first accredited ATE program. From 1970 to 1983 there was very little change in the educational approach to athletic training (Catlaw, 1999, Weidner & Henning, 2002). However, by 1983, athletic training reform began to take shape, yet the ATE community did not fully feel the impact of this reform movement until 2004.

Athletic Training Education Reform

During the 1980s, the NATA transitioned from the approved curriculum format to formal curriculum regulation, provided by the Professional Education Committee of the NATA (Perrin, 2007). These guidelines prompted the initial stages of the competency-based education model. In 1983, the first competencies in athletic training set ATE reform in motion (Perrin, 2007). The reform movement of the 1980s began to

redefine the profession of athletic training. In 1990, athletic training gained recognition from the American Medical Association as an allied health profession (Perrin, 2007). This important recognition would pave the way for further development of the athletic training educational standards.

In 1991, the establishment of the Joint Review Committee in Athletic Training (JRC-AT) began as a committee on accreditation serving under the Commission on Health Education and Allied Health Programs (CAATE, 2012). The foundational principle of the JRC-AT was to utilize the 1983 competencies in athletic training and develop a set of standards and guidelines for curriculum accreditation (Perrin, 2007). The Commission on Health Education and Allied Health Programs (CAAHEP), began serving as the ATE program accrediting body.

AT educational reform and continued progress of the athletic training profession in the late 20th Century led to the elimination of internship programs. In 1998, the JRC-AT submitted the recommendation to the NATA that all ATE programs formally move to athletic training degree-granting status and accreditation by the Committee on Health Education and Allied Health Programs (CAAHEP). These recommendations by the JRC-AT formally exclude the NATA internship programs thus encouraging all programs to move educational programming to curriculum-based programs. ATE programs that chose not to pursue an AT curriculum-based education program would sacrifice the educational opportunity for any athletic training students to sit for the national certification examination. In 2004, the NATA discontinued the internship program path to certification (Perrin, 2007)

The CAAHEP initially accredited ATE programs until June 2006. In 2007, the JRC-AT separated itself from CAAHEP and established the Commission on Accreditation of Athletic Training Education (CAATE). CAATE now serves as the accrediting body for accreditation of the ATE programs (CAATE, 2012)

The Board of Certification Inc. Role Delineation Study/Practice Analysis, 6th Edition

The BOC role delineation study identifies the domains of practice for the entry-level athletic trainer, as well as provides the continuing education standards, illustrated in Table 1 (BOC Inc., 2011). The role delineation study also provides the outline for the BOC examination. The BOC examination must be passed by the athletic training student in order to practice as a Nationally Certified Athletic Trainer (ATC) (BOC Inc., 2011). The BOC examination maintains a central theme to provide an assessment of the areas of professional practice, ensuring entry-level practitioners will do no harm to clients, employers, the profession, and themselves. In order for the BOC examination to remain reliable, valid, and fair, the Sixth Edition Role Delineation study was commissioned in October of 2008. The Role Delineation study establishes the content for the BOC examination based upon previously recognized methods in athletic training. These established methods are are identified by a review of existing role delineation study supplemented by practice analysis, expert knowledge, and practice surveys conducted on a large scale of the athletic training population. (BOC, Inc., 2011).

Domain Name	Description	Tasks	Knowledge & Skills
Domain 1 Injury/Illness Prevention and Wellness Protection	Educating patients in injury/illness risk management	Needs a verb Injury/Illness risk management, Interpret Data and Screening, Educate individuals regarding equipment, Maintain facility standards, Maintain/Improve physical conditioning programs, Promote Healthy Lifestyle	Apply effective communication skills, Identify resources, Examine risks
Domain 2 Clinical Evaluation and Diagnosis	Creating standard evaluation practices and differentiation of clinical decision making	Acquire medical histories, Use palpation and observation in evaluation, Use appropriate tests, Educate patients, Formulate clinical diagnosis	Interpret evaluation findings, Evaluate various injury/illnesses, Relate symptoms with findings, Questioning
Domain 3 Immediate and Emergency Care	Conducting standard of care practices based on emergent trends in proper care of injured patients	Coordinate care, Implement referral procedures, Execute immediate and emergent care, Implement immediate care strategies	Analyze and Identify emergencies, Combine knowledge of evaluation and prevention, Apply pharmacological agents, Transfer care to appropriate medical professionals, communication, administration,
Domain 4 Treatment and Rehabilitation	Creating programs for the return to normal activity for best possible performance	Acute/Chronic - Therapeutic/conditioning programming, Use appropriate therapies for injury/illness management, Apply brace, splints, taping for protection, Evaluate for return to participation	Evaluate progress in treatment, Justify use of therapeutic modalities and exercises, Compare the use of one modality over another, Differentiate phases of rehabilitation, Communication, Questioning, Interpret and Synthesize information, Problem-Based Learning, and Critical Thinking
Domain 5 Organizational and Professional Health and Well-Being	Complying with professional and organizational practices providing fulfillment of practice standards for the well-being of patients	Verb Individual/Organizational development, Support organizational growth, development, and sustainability, Compile documentation, Plan and develop protocols Know professional standards and practice acts of the profession, Develop support and referral procedures	Designing, Implantation, Constructing, Prediction, Summary, Development, Communication, Synthesize

Table 1 Domains of Athletic Training
(BOC Inc., 2011)

The National Athletic Trainers' Association Fifth Edition Educational Competencies

The NATA Fifth Edition Athletic Training Education Competencies outlines nine educational content areas and standards of academic expectations required of CAATE accredited ATE programs (BOC Inc., 2011). Table 2 illustrates the nine content areas for ATE. ATE programs rely on the introduction, practice, and mastery of more than 400 competencies and 1,100 proficiencies in the nine NATA content areas and the

five BOC domains. Walker, Weidner, and Armstrong (2008) refer to the athletic training education competencies and definition of clinical proficiencies as "performing with expert correctness and facility" (p. 386).

Content Area		Description
Evidence Based Practice	EBP	Incorporate best available evidence with clinical skills to maximize patient outcomes.
Prevention and Health Promotion	PHP	Develop/Implement strategies and programs to prevent injuries/illness and promote overall health.
Clinical Examination and Diagnosis	CE	Apply clinical reasoning skills to assimilate data, select appropriate assessments in anatomy, physiology, and biomechanics, and formulate a differential diagnosis.
Acute Care of Injury and Illness	AC	Knowledgeable and skilled in the evaluation and immediate management of acute injuries and illnesses
Therapeutic Interventions	TI	A broad range of interventions from rehabilitative activities, contemporary therapeutic equipment/modalities as well therapeutic interventions using prescription and nonprescription medications
Psychosocial Strategies and Referral	PS	Recognition of patients exhibiting abnormal social, emotional and mental behaviors with the ability to intervene and refer these individuals as necessary
Healthcare Administration	HA	Working within a complex healthcare system, understanding of risk management, healthcare delivery mechanisms, insurance, reimbursement, documentation, patient privacy, and facility management
Professional Development and Responsibility	PD	Maintain current competence in change world of healthcare
Clinical Integration Proficiencies	CIP	Represent the synthesis and integration of knowledge skills, clinical decision-making into actual patient care.

Table 2 AT Educational Content Areas
(National Athletic Trainers' Association, 2011).

The Treatment and Rehabilitation Domain Tasks, Knowledge and Skills

The Treatment and Rehabilitation (TR) domain is one of the five practice domains for athletic training and comprises 22% of the national certification examination as identified in the BOC, Inc. Role Delineation Study/Practice Analysis, 6th Edition (BOC, Inc. 2010). Each of the five practice domains is further classified into specific domain tasks, with statements of knowledge and skills. The TR domain consists of six standard tasks (Table 3) these standard tasks, incorporate the NATA Competencies 5th Edition (Table 2) in the overall introduction, practice, and mastery of the standards. The NATA competencies are very similar to public education systems core competencies adopted by various state boards of education, such as the Texas Essential Knowledge and Skills (TEKS). The BOC, Inc., domain tasks along with the NATA 5th Edition Competencies provided the expected knowledge and skills an AT student should possess upon completion of the entry-level degree program. Once a patient sustains an injury/illness; the Certified Athletic Trainer is capable of developing, administrating, and implementing a treatment/rehabilitation plan of care (BOC, Inc. 2010). This plan of care is under the direction of a physician prescribing the treatment/rehabilitation intervention. Each plan of care must be within the state's practice act and/or the BOC, Inc.'s standards of professional practice (BOC, Inc. 2010). The overarching goal of the treatment/rehabilitation plan is to relieve current areas of concern and return the patient to normal optimal levels of activity. Gaining further understanding of the TR domain requires an explanation of the domain's six practice tasks (BOC, Inc. 2010).

Domain Task No.	Domain Task
040100	Administer therapeutically and conditioning exercise(s) using appropriate techniques and procedures to aid recovery and restoration of function.
040200	Administer therapeutic modalities (e.g., electromagnetic, manual, mechanical) using appropriate techniques and procedures based on the individual's phase of recovery to restore functioning.
040300	Apply braces, splints, or other assistive devises according to appropriate practices in order to facilitate injury protection to achieve optimal functioning for the individual
040400	Administer treatment for the injury, illness, and/or health-related conditions using appropriate methods to facilitate injury protection, recovery, and/or optimal functioning for individuals.
040500	Reassess the status of injuries, illnesses, and/or health related conditions using appropriate techniques and documentation strategies to determine appropriate treatment, rehabilitation, and/or reconditioning and to evaluate readiness to return to a desired level of activity.
040600	Provide guidance and/or referral to a specialist for individual(s) and groups through appropriate communication strategies (e.g., oral and education materials) to restore an individual(s) optimal functioning.

Table 3 TR Domain Tasks
Note. Treatment and rehabilitation domain task identifications **(**Board of Certification, Inc. 2011).

Administer Therapeutic and Conditioning Exercises

Athletic trainers use foundational knowledge from the biological sciences, biomechanics, exercise physiology, human anatomy and physiology, and injury pathology for therapeutically and conditioning treatment plans. Treatment plans follow the healing process of the injured area, as well as continued assessment during the course of the healing process. Throughout the process, the AT maintains awareness of therapeutic medication used during the injury healing process (BOC, Inc. 2010).

Rehabilitation programs primarily involve the use of therapeutic exercise in cardiovascular and neuromuscular treatment. Exercises incorporated into this approach include, but are not limited to, aerobic/anaerobic, adaptations principles (overload, specific adaptations to imposed demands, daily adjusted progressive resistant exercises), balance training, and muscle strength, flexibility, and endurance (BOC, Inc. 2010).

Administration of Therapeutic Modalities

The use of therapeutic modalities encourages an optimal healing environment while also providing pain and swelling management for therapeutic exercises and treatment. Therapeutic modalities come in the form of electromagnetic, manual therapy, mechanical therapy, and acoustical (sound/ultrasonic) energy. Further use of therapeutic modalities includes soft tissue manual therapy, electrical stimulation, ultrasound, as well as thermal and cold therapies. Throughout the use of the aforementioned therapeutic modalities, the AT has to maintain proper awareness and preventative measures to avoid the transmission of blood-borne pathogens through wound care and to prevent the transmission of bacterial/viral infections (BOC, Inc. 2010).

Application of Braces, Orthotics, and Assistive Devices

During the treatment/rehabilitation process, the patient may need corrective measures used in the appropriate treatment plan. Protective devises should be used when the treatment/rehabilitation plan requires protecting the injured area and to assist in restoring normative function. The AT possesses the knowledge and skills to construct and develop orthotics for further treatment intervention. These devices come in the form of orthotics, splints, ambulation devices, and any device designed to limit or encourage

body range of motion or support. The AT must also be familiar with all governing body regulations regarding the use of assistive devices in return to play activity. (BOC, Inc., 2011).

Administration of Treatment for Injury, Illness, and/or Health-Related Conditions

General illnesses and other health-related conditions are also evaluated and treated by the AT. The AT must be knowledgeable to evaluate and treat the most common pathologies affecting the body. Common pathologies affecting the body are systemic illnesses, communicable disease, bacterial, fungal, viral, and parasitic organisms. Due to the nature of the various causes of illness and health conditions, the AT's working knowledge of human physiology, and pathophysiology of the body's system must be comprehensive. The AT must recognize, treat, and provide a medical referral to the appropriate provider when dealing with illnesses (BOC, Inc., 2011).

Reassessment to Determine Appropriate Treatment, Rehabilitation and/or Reconditioning for Evaluation of Readiness to Return to a Desired Level of Activity

The AT is in a continual state of assessment and re-assessment of the patient's progress during the treatment and rehabilitation plan. Re-assessment provides feedback for the AT to analyze and assess how and when to progress the patient through the appropriate recovery levels and at an acceptable rate of progression. Additionally, the AT must be aware of the need for suitable cardiovascular and muscular recovery for patients to return to an optimal level of activity (BOC, Inc., 2011).

Systematic re-assessment provides the practice of setting short-term goals for the patient. Assessing short-term goals provides the patient and AT a guide to progress

through the TR plan as indicated by the healing process. Additionally, short-term goals deliver expected outcomes for the patient as he/she moves forward for a return to activity (BOC, Inc., 2011).

Return to activity is based upon the patient's ability to progress through the plan and advance toward more complex therapeutic exercises. Such return to activity progressions include advanced strength and conditioning (plyo-metrics, speed, agility, power, endurance, and core stability). During the course of the return to activity phase, the AT must continually be aware of the healing process. Furthermore, when appropriate, the AT should initiate a referral for physician clearance (BOC, Inc., 2011).

Provide Guidance and/or Referral to Specialists through Appropriate Communication

The AT is responsible for providing appropriate communication to the patient at all times. Communication includes the setting of goals, expectations for home programs and desired outcome rationales for activities. The AT has to ensure correct communication regarding precautions and compliance within the period of the TR plan (BOC, Inc., 2011).

Patient education is also vital to the success of appropriate communication. Documentation and written instructions provide outlines for plan implementation. The AT may select video feedback, models, and handouts to educate the patient. These communication strategies provide expectations and understanding of the patient regarding the treatment/rehabilitation plan (BOC, Inc., 2011).

Another critical concern for patient communication is the potential psychological implications that may arise from the injury and/or illness. The AT should always

consider the patient's psychological condition when communicating with the patient, family members, and any other authorized individuals. In the event, that a psychological intervention is needed, the AT should be sensitive and respectful of the situation. Additionally, the appropriate referral and support systems should be presented to the patient and/or family in the event of intervention (BOC, Inc., 2011).

Regional University Athletic Training Curriculum

Athletic training students must learn how to communicate the competencies acquired through cognition and apply them directly to the psychomotor domain. Furthermore, athletic training students must relate knowledge to practical application through critical thinking and problem solving (Walker, Weidner, and Armstrong, 2008). To accomplish these goals, the ATE curriculum at RU consists of 73 hours within the biological sciences, fitness, and sports science, and athletic training. Courses in Athletic Training (ATTR) indicate athletic training core, 18 hours of the core are specific to clinical field base education. Table 4 represents RU athletic training major core courses and how each course aligns with the instructional methodology (theory and application). The TR domain encompasses many content areas offered in multiple athletic training courses. Table 4 also demonstrates the courses that have at least one TR competency introduced, taught, and assessed. This demonstration indicates a formal instructional gap between theory and application in 39 hours of course work.

Course Number	Course Title	Hours	Theory	App.	TR Domain
ATTR 1310	Introduction to Athletic Training	3	X		X
ATTR 2302	Basic Athletic Injury Care	3	X		X
ATTR 2321	Athletic Training Field Experience I	3	X	X	X
ATTR 2322	Athletic Training Field Experience II	3	X	X	X
ATTR 3310	Rehabilitation & Reconditioning for AT	3	X		X
ATTR 3321	Athletic Training Field Experience III	3	X	X	X
ATTR 3322	Athletic Training Field Experience IV	3	X	X	X
ATTR 3340	Therapeutic Modalities for Athletic Trainers	3	X		X
ATTR 3350	Injury/Illness Evaluation I – Lower Extremity	3		X	X
ATTR 3351	Injury/Illness Evaluation II – Upper Extremity	3		X	X
ATTR 3352	Injury/Illness Evaluation III – Head/Neck/Spine	3		X	X
ATTR 4140	Pharmacology in Athletic Training	1	X		X
ATTR 4141	Pathology of Athletic Injuries	1	X		X
ATTR 4142	Medical Aspects of Sports	1	X		X
ATTR 4143	Equipment Fitting, Bracing, & Orthotics	1	X	X	X
ATTR 4144	Current Topics in Athletic Training	1	X		X
ATTR 4240	Organization/Administration of Athletic Training Programs	2	X		X
ATTR 4321	Athletic Training Field Experience V	3	X	X	X
ATTR 4322	Athletic Training Field Experience VI	3	X	X	X
FSSC 3302	Nutrition	3	X		X
FSSC 3313	Kinesiology	3	X		X
FSSC 3314	Physiology of Exercise	3	X		X
FSSC 3360	Instruction of Strength & Conditioning	3	X	X	X
FSSC 4304	Statistical Methods	3	X		
BIOL 2410	Essentials of Human Anatomy & Physiology	4	X		X
BIOL 3418	Advanced Human Anatomy	4	X		X
CHEM 1301	General Chemistry I	4	X	X	
OR CHEM 1110	Essentials of Chemistry		X	X	

Table 4 RU AT Courses

Note. AT major core courses at Regional University consists of 73 hours

Theory Application Gap: The Theoretical Framework and the Effects of the Gap on Professional Practice and Assimilation

ATE programs are competency-based programs. Learners are first exposed to new information (theory) through a didactic medium followed by practical (application) clinical field experience. The theory application gap phenomenon is the framework that guides this study. Understanding the theory application gap requires the reader to understand the process of the transfer of knowledge and the application of knowledge. This section of literature will outline the theoretical framework of the theory application gap.

The Theory Application Gap

The theory application gap exists when there is a breakdown in the classroom and clinical practice integration. This phenomenon is well documented in nursing education journals (Baxter, 2007). Baxter (2007) noted nursing students face two areas of concern when dealing with the theory application gap. First nursing students face the problem of a "reality shock" when placed in a clinical setting where theory learned in class is not practiced within real-world settings. Second, the application of evidence-based practice is less likely to occur in the clinical education setting if the professional clinician responsible for supervising the student is not practicing evidence-based medicine (Baxter, 2007).

This phenomenon is not limited to nursing education alone; AT education equally has concerns regarding preparing competent practitioners. Carr and Drummond (2002) noted that a gap in theory and practice existed due to clinical instructor roles

within an ATE and current evidence-based (best practice) standards. Carr and Drummond (2002) concluded clinical, and classroom instructors should have a consistent physical presence, cooperation, and communication between each other and the learner to enhance the AT student's education. The clinical preceptor must remember he or she is also an educator and, therefore, demonstrate a desire to enhance the AT student's ability to narrow the theory application gap (Carr & Drummond, 2002). The parallels between the work of Baxter (2007), Carr and Drummond (2002) demonstrate the importance communication and collaboration play in the narrowing of the theory application gap.

Employers of recent AT graduates suggest students are knowledgeable, but lacking, in the clinical practice skills necessary to be a successful practitioner (Carr, 2011). The thematic deficiencies noted in the study performed by Carr (2011) revealed students, who were three-to-five years past graduation, had several insufficiencies. Insufficiencies include interpersonal communication, decision making/independence, initiative, confidence, and ability to learn from mistakes. The goal of the clinical education experience is for the student to become a better practitioner of clinical methods. Allowing for a transition from proficiency (performing a skill correctly) to mastery and clinical decision-making abilities (Sexton, 2011). Clinical preceptors model the professional behavior and attributes needed by the AT student. Modeling by the supervisor is performed under direct supervision of the AT student. Direct supervision is defined as constant audio, visual, and verbal contact (Sexton, Levy, Willeford, Barnum, Gardner, Guyer & Fincher, 2009; Sexton 2011). If the goal of the clinical education

experience is for mastery, then both student and preceptor must be willing to collaborate to bridge the gap between theory and practice.

Streveler (2013) performed the first study of the theory-application gap and ATE. This study examined learners' understanding of the differences between information taught in the classroom (theory) and the practice standards implemented in the clinical practice. As previously noted, Streveler concluded that the vast majority of research conducted in this area has been within the field of nursing. The results of this study parallel the research performed in the field of medical education and nursing (Streveler, 2013).

In order for AT educators to bring about change in the theory application gap, an understanding of the didactic instruction and clinical practice implementation portions must be communicated effectively. Communication between educators and clinical educators must improve to help eliminate the gap imposed by the educators presenting the didactic and clinical education. Carr (2002) indicates cooperation in didactic instruction is greater among classroom instructors versus clinical instructors. Carr's research suggests the gap in theory application may also be the result of poor communication between the classroom and clinical instructors. McDaniel and Colariulli (1997) describe the collaboration between faculty and clinical instructors as a means to reduce the gap in the application. Carr (2002) concluded effective instruction is a two-way process between the didactic and clinical instruction. While increased collaboration between classroom and clinical instructors can lead to effective instruction and greater communication, engagement with the student still must be met to create autonomy for

learning (McDanile & Colariulli, 1997; Carr, 2002)

Narrowing the Theory Application Gap

Nursing education addresses the theory application gap in some countries by limiting the time when clinical education is provided, such as the final year of formal study. Additionally, clinical support is placed on other health professionals to assist the student. In the UK, 50% of nursing students are integrated into clinical practice early on in the degree program (Carson and Carnwell, 2007). Integration of the clinical mentor is important in narrowing the theory application gap (Duffy & Watson, 2001; Sexton, 2011). These mentors provide a link between the clinical setting and the classroom by facilitating learning opportunities and engaging the student in exercises to increase their transfer of learning and application of knowledge (Duffy & Watson, 2001).

Transfer of learning. Transfer of learning is the process by which a learner explores how theoretical information is commuted from one context to another, with shared characteristics, through critical thinking (Yang, 2012). Problem solving allows a close association with the transfer of learning when prior knowledge is applied to solve the problem (Yang, 2012). Transfer of learning has three “features” as described by Yang (2012) – task features, learner features, and organizational features. Each feature describes a portion of the transfer of knowledge. Within task features, students apply behavior opportunities when learning a new task through practice. Through the learner feature, students’ affective disposition plays a role in the transfer of knowledge, involving their attitude and willingness to learn within the curriculum. The final feature described by Yang is one of the organization. The organizational feature is how the

program's curriculum is designed and implemented. In the case of teacher training programs, this includes supervision during practice, as well as the appointment to a school for student teaching (Yang, 2012).

Yang's research within pre-service teacher training examined how pre-service teachers developed critical thinking skills and transferred this learning into practice. To aid the process of transfer of learning, the educator must develop the critical thinking skills of the student (Yang, 2012). Once a student is capable of the transfer of learning, how the student applies the knowledge in real world situation becomes the focus.

ATE programs rely on the laboratory and field experiences to transmit didactic theory into practical application. Research indicates a gap in the transfer of knowledge from the classroom to the practical application of the clinical component, identified as the theory application gap (Anderson, Mitchell, & Osgood, 2008, Carr, 2002; Carson & Carnwell, 2007; Levin, 2010; Maben, Latter, & Clark, 2006; and Waterman, Webb, & Williams, 1995). The AT student faces the theory application gap encountered in other allied health fields (Anderson, Mitchell, & Osgood, 2008; Levin, 2010; Carson & Carnwell, 2007; Maben, Latter, & Clark, 2006; and Waterman, Webb, & Williams, 1995).

Learning occurs most often when a learner successfully transfers what is learned into new situations (Bransford, 2000). New knowledge must then connect with previous knowledge allowing for additional learning to take place. Transfer of knowledge through PBL is the way in which learning differentiates itself from memorization. Throughout

the education of the AT student, transfer of learning must begin early in the curriculum and be fostered throughout the clinical field experiences.

Transfer of learning is essential for the AT student in developing the necessary critical thinking skills required to assess, treat, and progress a patient who has sustained an injury/illness. Furthermore, problem solving is necessary to analyze a patient's response to injury/illness while providing the appropriate clinical decision for recovery. Research conducted by Walker (2012) emphasizes the need for critical thinking. Walker's belieces critical thinkis is essential for creating/evaluating administration documents, treatment plans, strategies to communicate, discover methods for evidence-based practice, and decision making in return to activity for patients. These areas of emphasis noted by Walker support the importance of transfer of learning throughout the AT curriculum.

Application of knowledge. Application of knowledge is the process by which new knowledge is applied to practical situations; it is also the most difficult to cultivate in students (Desforges and Lings, 1998). Desforges and Lings (1998) describe educators going to great lengths to encourage application of knowledge through a variety of media, such as projects, investigations, and problem solving. Through the constructivist perspective of the application of knowledge, students create applications based on a schema representing the theory. Desforges and Lings (1998) suggest a learner has the following necessary elements for learning at the minimal level: active knowledge base, domain specific application, self-motivation, and experience in areas specific to the domain where transfer or learning is expected (Desforges and Lings 1998, p. 396).

Applying new knowledge in this manner requires the AT educator to engage the learner in ways that challenge him or her academically (Desforges and Lings 1998).

Critical thinking is essential for athletic training students and is one of the core components of PBL (Dochy et al. 2003). Walker (2005) identifies critical thinking as the personal ability to solve problems and create solutions based on the information obtained. Furthermore, critical thinkers may exhibit a disposition for critical thinking through one of the seven traits: inquisitiveness, open-mindedness, systematical, analyticity, truth seeing, self-confidence, and maturity (Walker, 2005). AT students must learn to evaluate critical situations to create a differential diagnosis and then work systematically to develop a treatment and rehabilitation plan for patients (BOC, Inc., 2011).

The research above by Yang (2012) and Desforges and Lings (1998) provides an understanding of transfer of learning and application of knowledge. Additionally both studies suggest there is often a gap between learning and practice. In both the pre-service teacher education and allied health education programs students gain theoretical knowledge through a didactic medium and then must apply the theory into practice via a field-based course. Research indicates there is a theory application gap between theory and practical application in nursing, physical therapy, athletic training, and teacher education programs (Baxter, 2007, Carson & Carnwell, 2007, Carr, 2002). This theory application gap exists when a transfer of knowledge breakdown occurs in the classroom and clinical practice integration (Carr, 2002). Individual learners have a difficult time connecting the didactic theory with practical application.

The application of knowledge is dependent upon the learner's ability to connect the discovery concepts and results with the product of practice. The learner must see the need to discover improvement patterns and then apply the knowledge gained. Coursework within the ATE program requires the learner to apply new knowledge of treatment and rehabilitation into practice. Application of knowledge takes the learner from a passive state into a state of action and implementation. Applying new knowledge to the practice setting encourages further discovery, as well as fosters, continued learning, and growth.

Application of knowledge is the transfer of new information discovered through research (Becheikh, N., Ziam, S., Idrissi, O., Castonguay, Y., & Landry, R. 2010). Moreover, application of knowledge requires the learner to engage in connections made between researchers and users (Becheikh et al., 2010). These connections occur from the didactic to the clinical practice of athletic training education. This study attempts to address the problem-based learning connection, anticipating the application of knowledge in the classroom and practice setting. Becheikh et al. (2010) discovered six main steps for applying knowledge in the classroom and practice. These steps are: "1) knowledge generation, 2) knowledge adaptation, 3) knowledge dissemination, 4) knowledge reception, 5) knowledge adoption, and 6) knowledge utilization" (p. 7). Each step is facilitated in the PBL learning group. This information supports the theory of PBL being an effective instructional strategy encouraging the application of knowledge.

Learners generate new knowledge through interactions, self-directed learning, and discovery (Becheikh et al., 2010). Once the learner has generated the new

knowledge, he or she must adapt the information to current practice trends within the particular setting. Adapting knowledge to practice is essential for transfer of knowledge to be successful (Becheikh et al., 2010). Dissemination of the new knowledge depends on various media to distribute the information to practice. Areas of dissemination depend upon the credibility, relevance, interpersonal communication, and/or communication delivery methods for the new information (Becheikh et al., 2010). Reception and adoption of knowledge are how the learner sees the benefit of implementation, as well as the application of the knowledge in the form of adoption. Once the learner receives and adopts the new information, the practice of the new knowledge can begin (Becheikh et al., 2010).

Constructivism and Problem-Based Learning in Athletic Training Education Programs

Constructivism is learning theory and the process of learning where meaning and understanding are actively processed; it is not a specific teaching method (Kemp, n.d.). vonGlaserfeld (cited in Larochell, Bednarz, & Garrison, 1998) identifies constructivism as the use of knowledge as a tool within the experience of the learning environment. Constructivism is also identified as a process of learning where learners construct meaning from their learning based on personal and/or social experiences. Learners must equip themselves to meet the challenges of the learning environment, whether practical or theoretical. This connotation theorizes that the learner is capable of gaining depth and complexity of knowledge by way of constructing a viable learning option that is useful to the individual (Larochell, Bednarz, & Garrison, 1998).

Learners practicing constructivism gain knowledge through a variety of methods, including hands-on learning, discovery, and personal connection (Hendry, 1999). Educational theorists Dewey, Bruner, Piaget, and Vygotsky stated that the constructivist approach to learning enhances critical thinking, problem solving, and transfer of knowledge through connections. PBL uses real-world problems to develop learning relationships to the theoretical context, bridging the theory application gap (Chikotus, 2008). This student-centered approach to learning aligns with Howard Barrows' primary strategy for developing problem-based learning. Learning occurs through problem-solving while engaging the learner to search beyond the given information, producing depth and complexity of knowledge (Dochy et al. 2003, Duff & Jonassen, 1992).

Constructivism

Constructivism is a learning theory in which individuals construct understanding they have within the learning environment based on previous or current experiences (Oxford, 1997). The theory of Constructivism is an educational philosophy of knowing and a way of reflecting on teaching and learning (Oxford, 1997). Three primary educational theorist placed importance on the learner constructing and experiencing the educational process.

Piaget (1896-1980) identified the learner as the one who creates his or her learning environment. Piaget theorized cognitive development followed the same transformation to the environment as the body does to the changing environment (Oxford, 1997). The activities of the learner were the focus of Piaget's research. He is known for discovery and rediscovery of content through the construction of new

knowledge (Piaget, 1973). Piaget also believed in learning levels and structured his theory around the learner's development level. Joyce and Weil (1996) noted that Piaget believed the environments created by educators were where learning is built, developed, and changed over time.

Educational and curriculum theorist John Dewey (1859-1952), developed his theory based on experience drawn from the past, engaging in the present, and moving forward with new knowledge. Dewey authored "*Experience & Education"* (1983 [1938]) and viewed education theory as a means to deliver a curriculum that employs various experiences, thus creating a holistic education. Through the discussion offered by Dewey, educators provide social and educational experiences that will enhance student learning, thus providing a meaningful education. Oxford (1997) views Dewey's approach as one where the learner actively participates in the construction of learning within a social situation.

Vygotsky (1896-1934) also based his theory of learning on constructing knowledge based on social experiences. In Vygotsky's constructivist approach, knowledge is built upon the surrounding social structure of the learner and how the learner interacts with others within society (Oxford, 1997). Supporting the constructivist theory, Vygotsky developed the zone of proximal development. The zone of proximal development identifies the separation between development levels based on the learner's ability to solve problems. Additionally the zone identifies the level of the learner's potential to solve problems through the guidance of a tutor or interaction with peers (Oxford, 1997).

The work of Piaget centered on the individual learner and his or her learning experiences, whereas the works of Dewey and Vygotsky maintained the social environment plays an equal role in shaping the knowledge of learners. Each theorist argues the experience of the learner is critical to construct new knowledge from previous knowledge. These theories converge to develop the foundation of experience as it relates to athletic training education.

Experiential learning as an instructional strategy. Experiences develop from previous knowledge activities and gradually build toward a fruitful educational endeavor. Dewey states, "It is not enough that certain materials and method/s have proved effective with other individuals at other times. There must be a reason for thinking that they will function in generating an experience that has educative quality with particular individuals at a particular time," (p. 46). ATE clinical education adheres to this statement. During the course of the educational experience, the clinical instructor must meet the needs of the individual learning to provide the most productive experience.

Traditionally the clinical learning environment of the athletic training major has been "*see one, do one, teach one."* This model has closely followed that of the clinical model of medical education (Cooke et al., 2006). However, the learner's experiences within the clinical setting shape the clinical skills of the future practitioner. Furthermore, these same experiences develop the learner's psychosocial abilities (Cooke et al., 2006). It is important to develop clinical environments that will foster the growth of the student. "…medical novices require the opportunity to practice skills under the guidance of

experienced teaching physicians until they attain a high level of proficiency" (Cooke et al., 2006, p. 1341).

In a recent study performed at the University of Wisconsin Medical School, Ostlund, U., Kidd, L., Wengstrom, Y., and Rowa-Dewar, N (2010) discovered that quality improvement of surgical residents was increased with the use of problem-based learning. Additionally, residents participated in self-assessments, creation of learning goals and development of individual learning plans specific to each resident. This evidence supports the educational experience theories of Piaget, Dewey, and Vygotsky.

Discovery learning as an instructional strategy. The practice of discovery is primary to the PBL process. Discovery learning, theorized by Bruner in the 1960s, is also a constructivist view (Alfieri, 2010). Learning occurs through facilitator-led discovery, individual-guided discovery, case-based learning, as well as the PBL above (Alfieri, 2010). PBL development derives its foundation for discovery learning (Saunders-Stewart, Gyles, & Shore, 2012).

The researcher developing PBL should look at the work of Alfieri (2010) and the enhancement of discovery-related learning. Alfieri (2010) evaluated both unassisted and assisted guided-discovery tasks in learning. The results of his research indicate discovery learning alone has limited success, whereas assisted-discovery displayed increased active learning. This aligns well with the tutored approach of PBL. Developing a discovery learning application should engage and enhance the educational process. Alfieri (2010) suggests using at least one of the following approaches to the design of discovery learning: Scaffolding, reflection/feedback, and/or examples.

Service based learning as an instructional strategy. Historically, service based learning traces its heritage back to Harvard College in 1636. One of the stated missions of Harvard was to educate and train the clergy to minister to the needs of the community (Price, 2008). Hughes, C., Steinhorn, R., Davis, B., Beckrest, S., Boyd, E., and Cashen, K (2012) identify service learning as a teaching and learning strategy where learners actively take part in a community service project while reflecting on the teachings from the classroom about social justice issues within the community. Service learning is not just a strategy used within education, sociology, or religion curriculums. Allied-health and medical school curriculums also implement service-based learning into the development of health care professionals (Hunt, Bonham, & Jones, 2011). Service-based learning constructs meaning to the issues facing communities

Problem-based learning as an instructional strategy. PBL is the central constructivist theory used in this study and is a student-centered strategy involving small groups working collectively with a tutor who facilitates the problem. PBL is a combination of theory (idea), transfer of learning (process), and application (action) of knowledge. The PBL approach relies on real-world problems to bridge the gap between theory and practice. PBL is based on a real-world problem and is the medium by which knowledge is achieved. Further use of PBL develops critical-thinking skills, whereby new learning takes place through discovery and self-directed learning (McLoda, 1996; Catlaw, 1999; Barrows, 1994; Dochy, Segers, Van den Bossche, and Gijbels, 2003). The problem is based on a real-world concern and is the medium by which knowledge is achieved, and critical-thinking skills are developed. New understanding takes place

through discovery and self-directed learning (Dochy, Segers, Van den Bossche, and Gijbels, 2003). PBL groups include five-to-eight students where learning and the exchange of ideas are accessible (Lohman & Finkelstein, 2000). Through the implementation of a problem, the learner participates in developing an effective clinical reasoning process, self-directed learning skills, and increased motivation for learning, which engages the learner in problem-solving, critical thinking, discovery learning, and increased awareness of experiences (Barrows, 1994 & 1995). A discussion on the transfer of learning and application of knowledge identified how learners can narrow the theory application gap. These are two of the three components for PBL. This section will discuss constructivism and experiential learning as well as problem-based learning in medical, allied health, and athletic training education.

Howard Barrows is credited with the development of PBL while at McMasters University (Farnsworth, 1996, Heinrichs, 2002, Maker & Shiver, 2005). Barrows believed a medical student must be engaged in the learning process through real-world problems, employing interventions in a controlled environment, becoming a better practitioner. The objectives outlined by Barrows (structuring knowledge, developing clinical reasoning, developing self-directed learning, and increasing motivation) bring PBL within the umbrella of constructivism illustrated in Figure 2.

PBL is introduced through an ill-structured problem that simulates reality. Students work together with a tutor or through teacher/mentor to develop the solution to the problem. Students work with the problem according to their knowledge level and are challenged to evaluate further ways to solve the problem. Working with the problem

simulations, students acquire problem-solving skills that lead to the development of higher order thinking skills to arrive at a solution for the problem. This section discusses current research supporting the use of PBL within allied health and ATE programs.

Hendry, Frommer, and Walker (1999) studied constructivism, focusing their research on the fundamental aspects of how the constructivist theory directs the implementation of PBL. Hendry, Frommer, and Walker (1999) noted that Schmidt (1995) said the "cognitive construction on the part of the learner is well implemented in problem-based learning" (p. 248). The PBL model facilitates learning based on seven variables as described by Schmidt (1995): 1) prior knowledge, 2) quality of problems, 3) tutor performance, 4) group dynamics, 5) individual study time, 6) student interest in subject, and 7) achievement. Hendy, Frommer, and Walker (1999) concluded that all of the variables established by Schmidt can be assimilated into the constructivist design of PBL. Additionally, knowledge is created at the autonomous level by each student based on his or her goals and time spent within the learning environment.

The constructivist framework described by Savery & Duffy (2001) provides instructional principles that aid in the development of problem-based learning. Learning must be attached to a larger problem. The purpose is to learn, and not merely obtain a grade on the specific assignment. Facilitator support should be provided to learners to develop of personal ownership for the problem. Facilitators and Educators must construct an authentic task that engages the learner, thus allowing the learner to participate in the personal construction of the knowledge. This can be accomplished by establishing a learning environment that challenges the learner. Throughout the

constructivist approach to PBL, assessment should be done in an alternative framework, whether through learning communities or online collaboration. Lastly, constructivism in PBL should allow for reflection of the problem, how did learning take place, what was the learning process like and how is learning transferred to the real world (Savery & Duffy, 2001).

PBL can provide the connection between the classroom and clinical education that is needed to narrow the theory application gap (Smith-Goodwin & Wimer, 2010). Narrowing the theory-application gap will assist in preparing future athletic trainers to practice as competent professionals. Without narrowing the theory application gap, discrepancies in clinical education will continue to produce young professionals who may lack the necessary real-world application skills to practice AT in a patient-centered environment and to provide for the overall well-being of the patient.

Theory Application Gap and PBL in Athletic Training Education Programs

PBL and Critical Thinking

Throughout the process of PBL, athletic training students are engaging in activities that foster critical thinking. The PBL instructional strategy is designed to initiate learning with students, allowing the learner to participate actively in the process (Lesperance, 2008). Lesperance (2008) specifically studied the effects PBL has on critical thinking, identifying critical thinking as the process by which a learner engages in reflective, purposeful, and skillful thinking where decisions are made. Conversely, the critical thinking process involves questioning and discovery of learning (Lesperance, 2008). These important components of critical thinking are a byproduct of the PBL

process and a necessity for ATE.

Critical thinking offers the opportunities for AT students to grow in analyzing problems while integrating the practice into clinical application. PBL fosters the critical thinking process by analyzing the problem intervention and creating a plan using prior knowledge to acquire new knowledge to solve the problem (Leaver-Dunn, D., Harrelson, G., Martin, M., and Wyatt, T. 2002 and Lesperance, 2008). Studies evaluated by Lesperance indicated PBL was an effective instructional strategy that could enhance motivation, improve knowledge retention, and develop critical-thinking skills (Lesperance, 2008).

PBL and Student Development

The historical context of student development within the academy began with the pastoral and patriarchal faculty centuries ago rooted in the Christian moral character as a goal for education, to today's modern scientific study of human development as seen in student-development professional working alongside university faculty in the 20th and 21st Centuries (Evans, N., Forney, D., Guido, F., Patton, L., and Renn, K., 2010). The early human behavior theorists (Freud, Jung, and Skinner) were the first to study the psychological aspect rooted in human behavior vs. Christian moral character, thus leading to the implementation of human development positions at universities with the specific purpose of addressing student-development. The core of student-development is found within the offices of student-affairs and/or student-development and initially was seen as a vague concept (Evans et al. 2010). Various definitions exploit the vague nature of what student development delineates. Rodgers (1990) identifies student-development

as the research and study of adolescent and adult students, as a philosophical approach concerned with holistic growth (Evans et al. 2010). Miller and Prince (1976) suggest student development is " the application of human development concepts in postsecondary settings so that everyone involved can master increasingly complex developmental tasks, achieve self - direction, and become interdependent " (p. 3). Throughout the mid-to-late 20th century scholars established lines of student-development research. Three major theories emerged from scholars Arthur Chickering, William Perry, Lawrence Kohlberg, and (Evans et al. 2010). The study of student-development is a complex network of theories and exceeds the overarching goal of this study. Therefore, an overview of Chickering's and Perry's theories will be discussed (Evans et al. 2010). Specifically the importance student-development has within the university setting, athletic training education and the role it plays in problem-based learning.

Student-development within the university setting. Arthur Chickering's and William Perry's psychosocial development theories provide a foundational understanding of student-development within the university setting. Exploring these two foundational theories will enlighten the reader to a greater understanding of student-development as psychosocial and cognitive approach to learning. The first theory discussed will be Chickering's Theory of Identity Development.

In his book *Education and Identity*, (1969) Chickering outlined his psychosocial theory prepared for faculty based on research he conducted from 1959-1965 while evaluating curriculum practices. Chickering's theory evolved from the personality

inventories, interviews and achievement tests he used to assess students at the end of their sophomore and senior years of college (Evans et al. 2010). Throughout his study, he noted the power the environment has to the student attending a university. Along with Linda Reisser, Chickering's Theory is based on seven vectors encountered by a university student. The use of the term vector indicates a direction and magnitude of influence that may (or may not) be linear from freshman level to senior (Evans et al. 2010). While the use of the term vector does not indicate a sequential order of the vectors presented, vectors can build upon each other providing a learner with the ability to adapt to complex situations, provide stability, develop emotional and intellectual strength, and the development of differentiation and integration of behaviors (Evans et al. 2010, Kozlowski-Gibson, 2015). The seven vectors (Figure 5) theorized by Chickering and Reisser (1993) demonstrate a broad awareness of the student-development throughout his or her time in college (Evans et al., 2010).

Chickering and Reisser also theorized seven key influences (Figure 6) of the university environment are influencing the development of college students. These key influences include *Institutional Objectives, Institutional Size, Curriculum, Teaching, Friendships and Student Communities, Student and Faculty Relationships, and Student-Development Program and Service* (Evans et al., 2010).

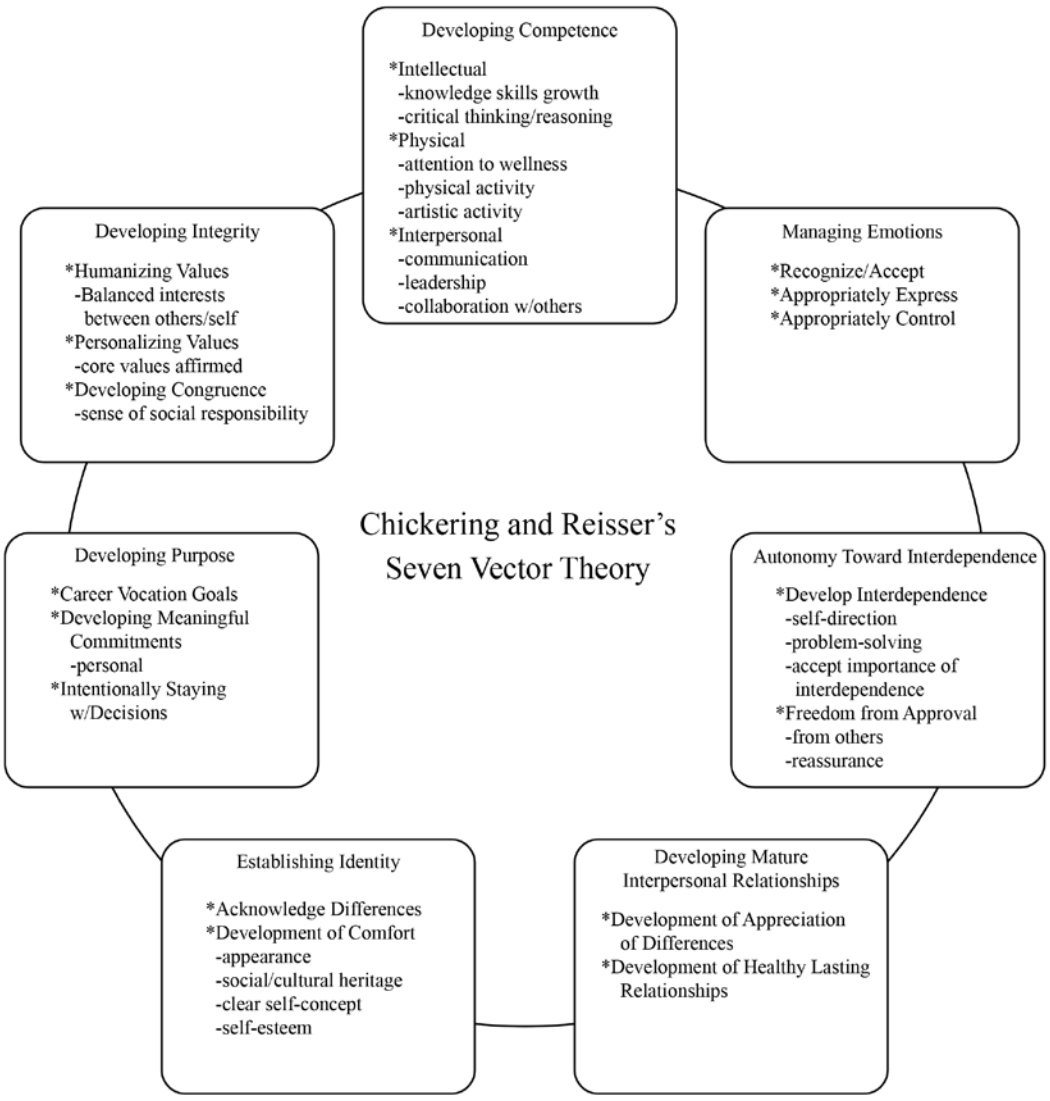


Figure 5 Seven Vectors
Note*:* Seven vectors of student development as described by Chickering and Reisser (Evans et al., 2010).

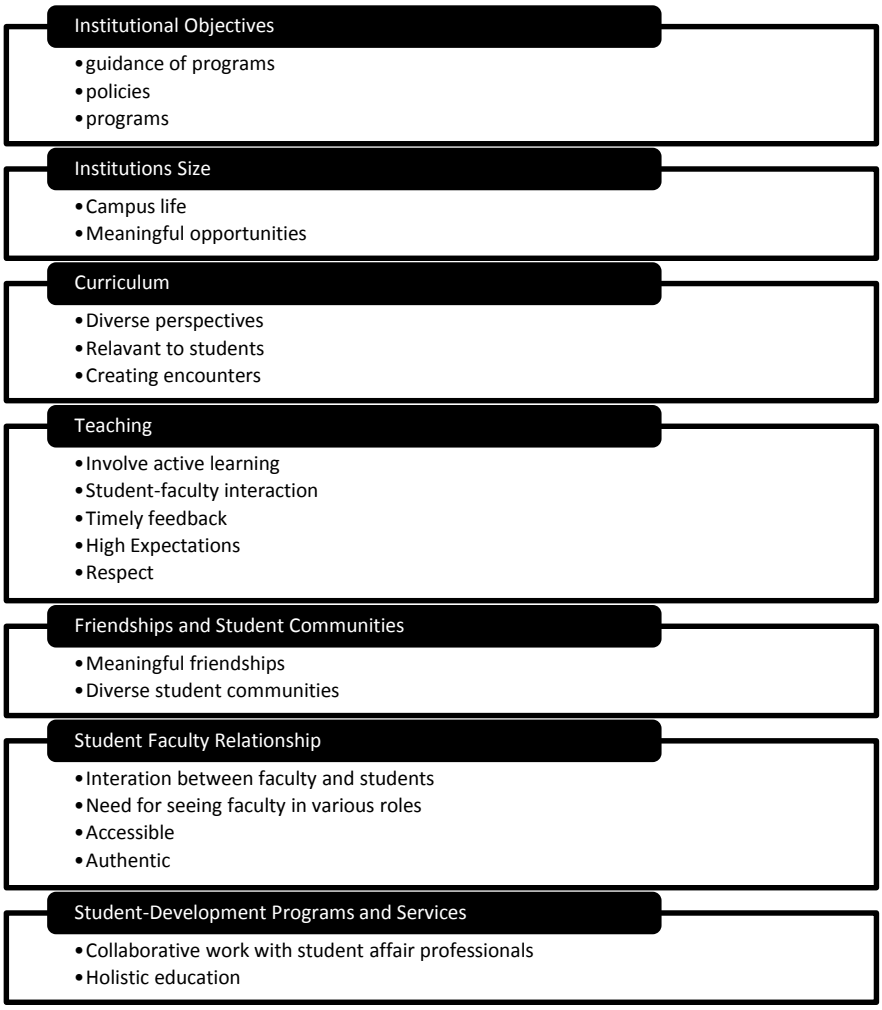


Figure 6 Environmental Factors
Note. Chickering and Reisser's Environmental Factors (Evans et al., 2010)

William Perry's theory of intellectual and ethical development is the result of research in the area of teaching and learning within the university setting, specifically how students engage, interpret and make meaning throughout the learning process (Evans et al., 2010). Perry's theory examines how students move from the simplistic forms of right-wrong, good-bad to the complex understanding of personal commitments

within the knowledge and relative beliefs (Evans et al., 2010). Unlike Chickering & Reisser, Perry's theory is an outline on the continuum of development known as the *Nine Positions* (Figure. 7). The positional view of Perry is development does not occur in stages but rather students can display a range of development within the positions. Perry identifies this as the "locus of central tendency or dominance among these structures" (Evans et al. 2010, p. 85). Actual development does not necessarily occur in one of the nine positions but rather in the transitions from position (Evans et al. 2010). A continuum of development occurs from the duality of development to a changing level of commitment. This is supported by the fundamental concepts of *duality, multiplicity, relativism,* and *commitment* (Evans et al. 2010).

In Perry's theory, position one, notes students see and engage the world in "polar" terms of right-wrong, black-white with the professional educator possessing the knowledge and providing information. The transition from position one into position two the learner begins to view the diversity of opinion as unwarranted confusion and may often reject diversity. In position three the learner begins to accept diversity, and authorities can disagree with an understanding that everyone has an opinion through multiplicity. The process of moving from dualism to multiplicity notes a change in the student's acceptance of right-vs-wrong and the acceptance of others opinions, transitioning into the fourth position (Perry, 1968, Elwell, 2004, Thomas, 2008 and Evans et al., 2010).

Position four reiterates the fact everyone is entitled to an opinion and begins to realize reasoning and understanding of what authority wants vs. what he or she know.

Positions five through seven sees the individual learner matriculating from dualistic to relativistic understanding of the world and begins to make a personal commitment towards the subject matter. Conversion from multiplicity to relativity enables the learner to identify the contextual nature of knowledge and how new knowledge can be analyzed and evaluated (Perry, 1968, Elwell, 2004, Thomas, 2008 and Evans et al., 2010)

Lastly, position eight and nine the learner reaches a commitment level where he or she experiences the implications of commitment and responsibility associated. Additionally the learning garners affirmation of the identity of commitment and realizes the ongoing development of commitment (Thomas, J., 2008, and Evans et al. 2010). This shift in identity moves from the simplest form of "being professional" to a committed professional engaged in the enhancement of the chosen field (Perry, 1968, Elwell, 2004, Thomas, 2008 and Evans et al., 2010)

Perry's scheme can be interpreted within the research in the intellectual development of engineering student by Palmer et al. (2000). Utilizing a longitudinal design and random sampling, Palmer et al. (2000) developed an interview process for assessing intellectual development based on the Perry scheme. Interviews were conducted at the end of the first year and junior fall semester. Palmer et al. (2000) findings suggested engineering students made the most significant improvements in position three (multiplicity) from the first year to the junior years.

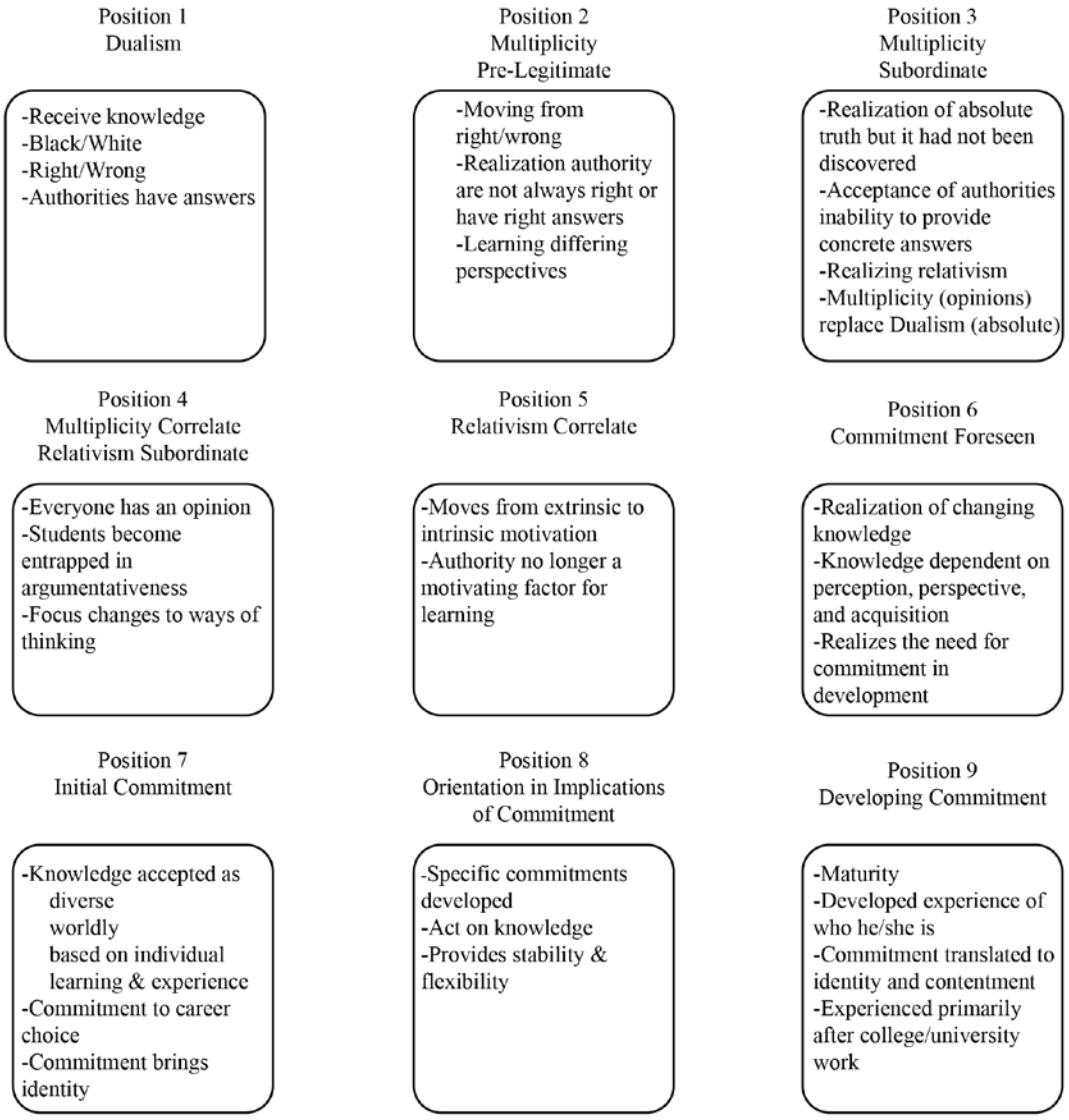


Figure 7 Perry's Positions
Note. Perry's Fundamental Concepts and Supporting Positions (Perry, 1968, Elwell, 2004 and Evans et al., 2010)

Hood and Deopere (2002) researched cognitive relationship development regarding age and education and intelligence. Freshman and sophomores participated in the study completing the Quick Test, Scale of Intellectual Development, and the Life Experience Survey. Perry's scheme was specifically measured through the Scare of

Intellectual Development. Hood and Deopere (2002) discovered there was a negative relationship between age and Perry positioning and a positive relationship between education and Perry positioning. This validated the researcher's interpretation of Perry's scheme as it relates to dualism and relativism (2002).

The work of Facion (cited in Pascarella & Terenzini 2005) examined how intellectual development is gained within critical thinking skills studying over 6000 nursing students. Facion administered the California Critical Thinking Skills Test (CCTST) and determined critical thinking gains were achieved as the student progressed in the ranks of academics. This study conducted by Facion did not compare or utilize the Perry scheme in the research design, however it provides supporting evidence of intellectual development growth as the student progresses through his/her coursework (Pascarella, & Terenzini, 2005).

Student development in athletic training education. Athletic training education relies on the process of professional assimilation/socialization to equip students for the rigors of academic course work as well as clinical education experiences. Research specific to student-development, as discussed in the previous sections detailing Chickering's and Perry's theories are not found in the ATE literature. Therefore, the terms professional assimilation/socialization are viewed as synonymous. ATE student-development focuses on the clinical education component and professional assimilation/socialization of the learner over the course of the degree plan. In the following sections, ATE professional assimilation will be discussed with a comparison to the research of Chickering and Perry.

Professional socialization in ATE was first studied by Pitney, Ilsley, & Rintala (2002) but is seen throughout the medical and allied health education fields. Pitney's study was performed prior to the educational paradigm shift in ATE where students were vetted through both internship programs and curriculum programs. The focus of the study was how nationally certified AT's adapted to the role of a high school athletic training professional after completion of a bachelor's or master's degree. The findings presented by Pitney indicate professional organization socialization as mostly informal requiring a commitment to continued learning of the professional.

Pitney, Ilsley, & Rintala (2002) note the process of professional socialization as a way of learning the "knowledge, skills, values, roles, and attitudes associated with professional responsibilities" through a two-part development process known as anticipatory socialization and organizational socialization (Pitney, Ilsley, & Rintala, 2002, p. 286) Anticipatory socialization is seen as the undergraduate experience through didactic formal educational components, whereas, organizational socialization occurs during induction to the profession as a practicing AT and sustained role development through mentoring opportunities, formal and informal continuing education. The parallels with Chickering and Perry can be seen within Pitney, Ilsley, & Rintala's study, even though this initial study was performed on practicing professionals vs. undergraduate students.

Pitney, Ilsley, & Rintala's study communicates the higher levels of the Chickering and Perry theories. Specifically within Chickering's theory friendships and diverse communities are developed through professional networking with administrators,

coaches, allied-health professionals, and the community (Pitney, Ilsley, & Rintala, 2002, Evans et al. 2010).

Professional expectations align specifically with the development of the intellect of the AT student. Mazerolle, T., Bowman, T., and Dodge, T. (2014) interviewed 19 ATE program directors seeking to answer the question of how do programs educate students on professional expectations. Through qualitative data analysis, two themes emerged with regards to the professional assimilation/socialization process: formal and informal. These major themes materialized from open ended questions presented during the interview process.

Formal assimilation/socialization followed a structured program typically directed by the AT faculty. The structured nature of the formal theme provides AT faculty to establish the expectations of the program while also asserting authority for policies and procedures. Formal assimilation is comparable Perry's scheme of dualism where students receive knowledge from an authority figure, and it is understood there are a right way and a wrong way of performing. Mazerolle, Bowman, and Dodge (2014) noted formal assimilation occurs through programmatic design by way of an *Introductory Course, Observation Hours, Orientation Sessions, Student Handbooks, AT Student Club Activity, and Organized Peer Mentoring.* Throughout the process of formal assimilation/socialization students can progress in Perry's scheme reaching multiplicity presumably during their second year of the program admission. Chickering theory recognizes the purpose of *Curriculum* (noted in the introductory courses, student handbooks), *Student-Development Programs* noted through orientation, student club

activity, organized peer mentoring) *and Services* (organized peer mentoring, observation hours), *Teaching, and Institutional Objectives* (noted through introductory course work, observation hours, orientations, handbooks).

The theme of informal assimilation is based solely on informal activities and spontaneity of the AT program. Program directors described this as the "fun and social" side of development. Group activities involving students, faculty, and staff include paintball, bowling, and social gatherings where students can mingle and grow to know the faculty and staff. Informal assimilation aligns with Chickering's theory of seven vectors. Mazerolle, Bowman, and Dodge (2014) noted how programs work to build relationships with their AT cohorts. Chickering identifies this as *Student Faculty Relationships, Institutional Objectives, and Friendships and Student Communities* (Evans et al., 2010). Furthermore, Perry's scheme allows for students to progress through the positions as relationship and understanding of one another develop over the course of the academic career (Evans et al., 2010)

Mazerolle, Bowman, and Dodge (2014) conclude professional assimilation/socialization occurs over the course of the student's time within the AT program. Structuring the professional assimilation into formal and informal themes allows students to develop over the course of time. Research conclusions by Mazerolle, Bowman, and Dodge (2014) provides a connection between AT professional assimilation/socialization and the theories presented by Chickering and Perry.

Student development within problem-based learning. PBL is a combination of theory (idea), transfer of learning (process), and application (action) of knowledge

into an approach that relies on real-world problems to bridge the gap between theory and practice. The real-world problem is the medium by which knowledge is achieved and critical-thinking skills are developed, whereby new learning takes place through discovery and self-directed learning (McLoda, 1996; Catlaw, 1999; Barrows, 1994; Dochy, Segers, Van den Bossche, and Gijbels, 2003). The student-development theories presented by Chickering and Perry can also be applied to student learning within PBL. The following synthesis provides the reader an understanding into the complexity of student-development through PBL.

Barrows and Kelson (1995) note five goals for student achievement in PBL. Analyzing these goals from, the perspective of the student-development theories, can assist educators in developing a holistic curriculum where learning and development occur simultaneously. Previously noted, Chickering's theory is not seen as precisely linear, whereas Perry's theory moves a linear line pursuing overall development. Each PBL goal, as defined by Barrows and Kelson (1995) will be analyzed based on Chickering's and Perry's student-development theories.

PBL Goal 1: Construct an extensive and flexible knowledge base. Constructing a knowledge base that is both extensive and flexible is more than the memorizing and learning of facts within a specific competency area (Hmelo-Silver, 2004). Chickering identifies this as developing competence through intellectual, physical and interpersonal growth (Evans et al. 2010). Whereas Perry's theory suggests, extensive and flexible knowledge is transitioning from dualism to multiplicity. According to Perry's theory

students begin the shift from receiving knowledge from authority to learning differing perspectives and opinions.

PBL Goal 2: Develop effective problem-solving skills. Problem-solving skills require learners to apply metacognition strategies (Hmelo-Silver, 2004). Kolodner, 1993 and Kolodner et al., 1996 (in Hmelo-Silver, 2004) note differing metacognitive strategies are best used with differing fields of study. The exampled noted is deductive reasoning is best suited for medial PBL domains, whereas, case studies are more appropriate for domains in architecture (Hmelo-Silver, 2004). Autonomy toward interdependence is how Chickering defines this pattern of development. Here learners begin to learn problem-solving skills and develop independence as a learner (Evans et al., 2010). The environmental factors effecting this PBL goal include curriculum design and teaching as defined by Chickering (Evans et al., 2010). Effective problem-solving skills are developed through the tutoring phase of PBL and the central curricular design for implementation (Barrows and Kelson, 1995). Perry identifies this position of development as multiplicity. Learners are engaged in learning through the realization and acceptance of relativism and opinions matter within the context of solving problems. There may be no right or wrong answer solving the problem since the focus of thinking has changed within the learner (Evans et al., 2010).

PBL Goal 3: Develop self-directed, lifelong learning skills. Learners develop an awareness of how they learn and their capability of comprehending new knowledge. Furthermore, learners recognize the need to grow as learners and begin to set goals (Hmelo-Silver, 2004). Again, autonomy towards interdependence is developed based on

Chickering's theory additionally the developing purpose vector begins to transform the learner. Developing purpose allows the learner to set clear goals for learning, develop commitment, and increases intentional decision making (Evans et al., 2010). Perry's theory offers a continuum from multiplicity towards relativism and foreseen commitment as seen in position five and six. The learner is now intrinsically motivated as authority is no longer a motivating factor. Learners experience changing of knowledge and identify a need for personal commitment to learning to develop a desire for life-long learning (Evans et. al, 2010).

PBL Goal 4: Become effective collaborators. Critical to the success of PBL is collaboration. Effective collaborators develop a common ground for discussion, resolve differences and become negotiators for reaching consensus among constituents (Barron, 2002 as cited in Hmelo-Silver, 2004). Chickering's vector of developing mature interpersonal relationships and developing integrity are closely related to becoming an effective collaborator. Through the effective collaboration, learners develop an appreciation of differences and humanize values of individuals. Development in these two vectors allows the learner to create a balanced interest between personal views and the opinions of other learners. Perry's position seven, initial commitment, correlates with collaboration. The initial commitment by the learner allows for the development of diversity in knowledge and is primarily based on individual learning (Evans et al., 2010). The understanding of knowledge as diverse relates back to the initial stages of multiplicity in position four where the learner recognizes opinions and the ability to develop arguments based on knowledge (Evans et al., 2010).

PBL Goal 5: Become intrinsically motivated to learn. Learners who are intrinsically motivated are driven by personal interests, challenges, and the feeling of accomplishment and satisfaction (Hmelo-Silver, 2004). Developing a problem to achieve this goal requires the educator to understand the various stages of student-development. Novice learners who have not transitioned from dualism to multiplicity in Perry's theory will have difficulty meeting this goal of PBL because they still learning as being externally motivated by grades or authority. Learners should have developed to position five, relativism correlate, where Perry identifies intrinsic motivations primarily occurs. While each learner may not have reached position five student-development will continue as the learner gains experience within the PBL model. Perry's positions, seven through nine, lead to commitment where the learner commits to learning and growth. Perry believed this primarily took place as the learner entered the upper levels of college work and continued throughout the professional career. Chickering's theory identifies the vectors of autonomy towards interdependence, developing purpose, and developing integrity as areas of development impacted by the goal of intrinsic motivation to learn. One of the key factors for interdependence is problem-solving and development of independent learning. Intrinsic motivation also outlines clear goals and developing purpose for learning while developing an overall sense of responsibility of gaining new knowledge (Evans et al., 2010).

PBL requires students to participate within a sociocultural dynamic. The sociocultural dynamic cultivates a student's social interactions as well as their ability to work in a collaborative environment (Hmelo & Silver, 2004). Again, this important

aspect of the PBL centered curriculum aims to develop the holistic student as also noted by Chickering and Perry (Lampert, 2001 and Evans et al., 2010). The benefit of the social practice, within the PBL curriculum, support the growth of discipline, formulation and evaluation of questions, arguments and explanations (Lampert, 2001; Evans et al., 2010).

PBL and Allied Health Education Programs

Allied health education programs have seen educational reform, as has ATE. The focus on entry-level education in allied health fields (i.e. physical therapy, orthotics/prosthetics, nursing, and occupational therapy) has transformed from mastery of technical skill to a more holistic approach to education. This new approach places emphasis on diagnosis, treatment and care, and assessment outcomes (APTA, 1996; Long & Grandis, 2000).

PBL within allied health education also has the support of faculty. Programs that have integrated PBL into the curriculum believe students have seen an increase in the integration of theory into clinical practice (Norman & Schmidt, 1992). Furthermore, faculty from allied health programs suggest PBL provides students with greater retention of learning, application of knowledge, and critical thinking skills (Barrows 1986; Camp 1996; Norman 1988; Lusardi, Levangie, & Fein 2002).

PBL encourages the incorporation of critical thinking and problem-solving strategies narrowing the transfer of learning gap or theory application gap, as well as developing self-directed and life-long learning skills (Farnsworth, 1996; Heinrichs, 2002; Maker & Shiver, 2005). In a 2013 dialogue between Diana Dolmans, a professor in the School of Health Professions Education at Maastricht University, and David Gijbels, a professor in the Department of Training and Educational Services at the University of Antwerp, the two colleagues discussed the future challenges PBL has within the allied health community. Gijbels asserts that research supports PBL as a strategy that has the ability to produce better outcomes regarding clinical knowledge and skills versus a traditional classroom instructional strategy (Dolmans & Gijbels, 2013). Throughout their discussion both scholars agree that PBL has many advantages, yet they also concur the learning that takes place within PBL is dependent on various factors. These factors include the learning environment, types of assessment used within PBL methods, teacher behavior (autonomy-supportive vs. controlling), and student characteristics (motivation) (Dolmans & Gijbels, 2013).

PBL and the University Classroom

While PBL is seen throughout medical education and allied-health education programs, the traditional educational setting has also benefited from the instructional strategy. The University of Delaware has successfully implemented PBL within the university classroom (Amador, Miles, & Peters, 2006). Research conducted by Gallagher & Gallagher (2013) demonstrates that students within a PBL classroom are more motivated, engaged, and satisfied as learners (Gallagher & Gallagher, 2013). Gallagher & Gallagher were also looking for unseen academic potential. Gallagher & Gallagher surmise the effects of the PBL classroom created a positive change for the teachers and how they viewed their students and the subsequent performance in academic growth. This demonstrates how a PBL curriculum adds value to the classroom (Gallagher & Gallagher, 2013). The rational for university implementation has been similar to that of medical education. PBL promotes self-directed learning, connecting course content with application, and collaborative learning (Amador, Miles, & Peters, 2006). Educators are transformed from the "purveyors of knowledge to participants in a process" (Amador, Miles, & Peters p. 18).

Intervention Strategies Using PBL

An intervention is described as a planned set of procedures aimed at educating an individual or group of individuals (Howell & Nolet, 2000). Intensive academic and/or behavioral interventions are characterized by their increased focus for students who do not respond to traditional, or less intensive, forms of instruction. The intervention can be increased by length of application, frequency, and duration of the specific application.

The instructional strategy of PBL is designed to guide the learner through an ill-structured problem, while encouraging the transfer or learning and the application knowledge. Various intervention strategies can be used to with PBL to enhance learner response. Figure 8 illustrates the various intervention strategies used to form a PBL instructional strategy.

Interventions can also be described as the process by which change is sought in a particular area of deficiency. One method used as a catalyst in the educational setting is the implementation of action research methodology. Action research should be utilized when seeking an innovative path to change (Somekh, 2006). The process of an intervention is an action component for change. The change is imitated through a particular medium (or intervention) whereby a desired outcome is sought. While PBL has been used as basis for medical school curriculum design, this study focused on the introduction a tutoring intervention using PBL as the facilitator of change with in the RU ATE program.

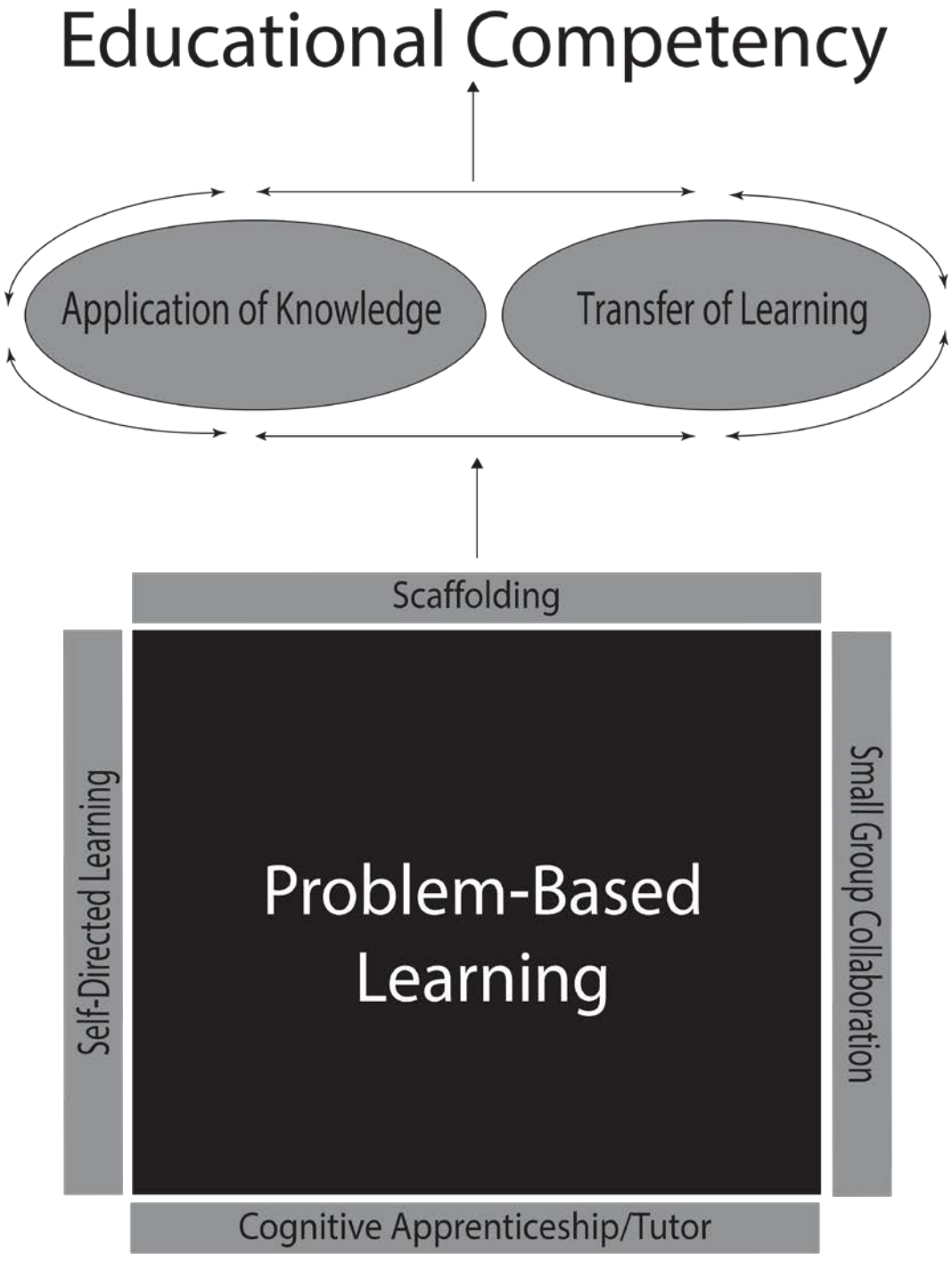


Figure 8 Intervention Strategies

In order to implement a change (intervention) the research methodology must also desire to evaluate the change. Action research combines the catalyst (change/action/intervention) with ongoing research of the participants to determine whether the change has a positive or negative response (Somekh, 2006). This involves the researcher entering into the real world of the study with the intention to strengthen the area of study and to gain additional knowledge (Checkland & Holwell, 1998). This method uses the intervention strategy to introduce an approach that provides the research with a collaborative process between researcher and participants, engagement in critical inquiry, focus on the social aspect of learning, and creates practice of reflective learning (Checkland & Holwell, 1998). The tutoring intervention using problem-based learning as the instructional strategy is the action within the research to solving the problems within the TR domain at Regional University.

This study proposes to use the following intervention strategies to implement a PBL in the TR domain for ATE:

- Scaffolding: Provides building blocks of previous knowledge to solve the problem and develop new knowledge (Schmidt, H.G., Rotgans, J., & Yew, E. 2011).
- Cognitive Apprenticeship with a PBL tutor: Acts as a facilitator of learning for small-group collaboration, guides the discussions of the groups as needed, provides scaffolding of previous knowledge to assist with the building of new knowledge, and encourages deeper thought and reflection of the problem (Schmidt, H.G., Rotgans, J., & Yew, E. 2011).

- Self-Directed Learning: enables individuals to place personal learning as a priority, provides engagement through a real world problem to invest in the solution, and creates a life-long learning attitude through personal responsibility for learning (Schmidt, H.G., Rotgans, J., & Yew, E. 2011).
- Small-Group Collaboration: promotes collegial development among peers, increases contact with the PBL tutor, and generates positive peer pressure to meet the needs of the group, develops effective communication among peers (Schmidt, H.G., Rotgans, J., & Yew, E. 2011).

Conclusion

The aforementioned studies identified the historical background of ATE and the RU curriculum. Furthermore a discussion on the theory application gap provided the theoretical framework of this study and lastly, PBL was introduced as an effective instructional strategy to narrow the theory application gap. Clear evidence demonstrates a lack of professional assimilation in entry-level practitioners, as well as their inability to think critically and problem solve (Carr, 2002; Carr 2012; Baxter, 2007, Walker, 2005; Lesperance, 2008). Furthermore, research suggests improving communication (McDaniel & Colariulli, 1997, Carr 2002) as well increasing clinical and cognitive mentoring opportunities (Carson & Carnwell, 2007; Duffy & Watson, 2001; and Sexton, 2011) as strategies for engagement within the PBL process.

CHAPTER III

METHODOLOGY AND METHODS

Methodology

Forthofer (2003) recognizes the importance of mixed-method studies in allied-health professions to patient care through the mutual support of quantitative and qualitative data. Mixed-method studies are especially important within allied-health fields by allowing for qualitative results to support the quantitative evidence in research, whereas importance is placed on quantitative results in traditional medical education (Forthofer, 2003). Since patient care is the primary focus of the TR domain, AT educators should develop studies incorporating qualitative evidence that supports the quantitative evidence of patient-centered care. Support from Raushcer & Greenfield (2009) points toward the use of qualitative data. Quantitative data plays an important role in predicting outcomes for patients, whereas the qualitative data probes the meaning of the patient's impression of the outcomes. This example given by Raushcer & Greenfield (2009) can be transferred to this study by using the self-assessment to evaluate the outcome of a PBL tutoring intervention and the impression of the PBL exercises within the ATE curriculum.

Creswell, Klassen, Plano-Clark, and Smith (2011) identifies mix-methods as the collection of both quantitative and qualitative data responding to the inquiry of the researcher. This approach allowed the researcher to view the questions from various angles through the collection of two independent data sets. One key point Creswell et al. (2011) noted in mixed-methods is the provision for a real-world practical approach to

research. This real-world approach takes action to evaluate and create possible solutions to resolve the problem being studied, specifically here PBL as tutoring intervention in the TR domain of the BOC. Inc.

Practical application of mixed-methods research has been successful in other allied-health fields allowing for greater autonomy for practice (Ostlund, Kidd, Wengstrom, Rowa-Dewar, 2011). Furthermore, Oslund et al. (2011) agreed that the convergent parallel design has been shown to provide an improved understanding of theory and empirical findings. Combining quantitative and qualitative data allows the researcher to assist in finding a connection between theoretical concepts and practical application (Oslund et al., 2011, Rauscher & Greenfield, 2009).

Research Questions

This mixed-methods study aimed to answer the central research question: How does a tutoring intervention in PBL narrow the theory application gap within the BOC, Inc. treatment and rehabilitation domain in an undergraduate athletic training education program at Regional University in Texas? The sub-questions of this research study were:

Q1: Does a tutoring intervention using the PBL instructional theory provide RU students in the ATE Program the knowledge and skills necessary to apply the theoretical information into practical application?

Q2: How does PBL in the ATE program change the content engagement practices of RU students within a formal tutoring intervention?

Q3: How do students rate themselves on a pre and post self-assessment in a PBL intervention?

Q4: How does a PBL intervention in the ATE program change the collaborative exchange among students within the classroom and clinical field experiences settings?

Study Design

Convergent Design of Mixed-Methods

The convergent mixed-method design was used to obtain different data sets on the same topic (Creswell & Plano-Clark, 2007). Ostlund et al. (2011) indicate triangulation as a means to draw an association between the theoretical and evidence produced by mixing the methods of data. Furthermore, Ostlund et. al. recommend the use of the triangulation model in medical research to strengthen a linkage between theory and application of the methods. This requires transparency of the researcher and the careful execution of the methods in order to articulate the researcher's intent.

All data were collected separately and then merged at the time of analysis using the convergent design. The convergent parallel design is where both qualitative and quantitative information are gathered during the study simultaneously and merged at the interpretation (Angell & Townsend, 2011). Each data collection sequence was independent in the study, allowing for the interpretation of the completed study through integration at the conclusion of the study (Creswell & Plano-Clark, 2007). This method of convergence is the preferred method among novice mixed-method researchers and is efficient in the design because traditional data collection and analysis are performed within the individual data set (Creswell & Plano-Clark, 2007). Figure 9 illustrates the convergent parallel mixed method approach for this study.

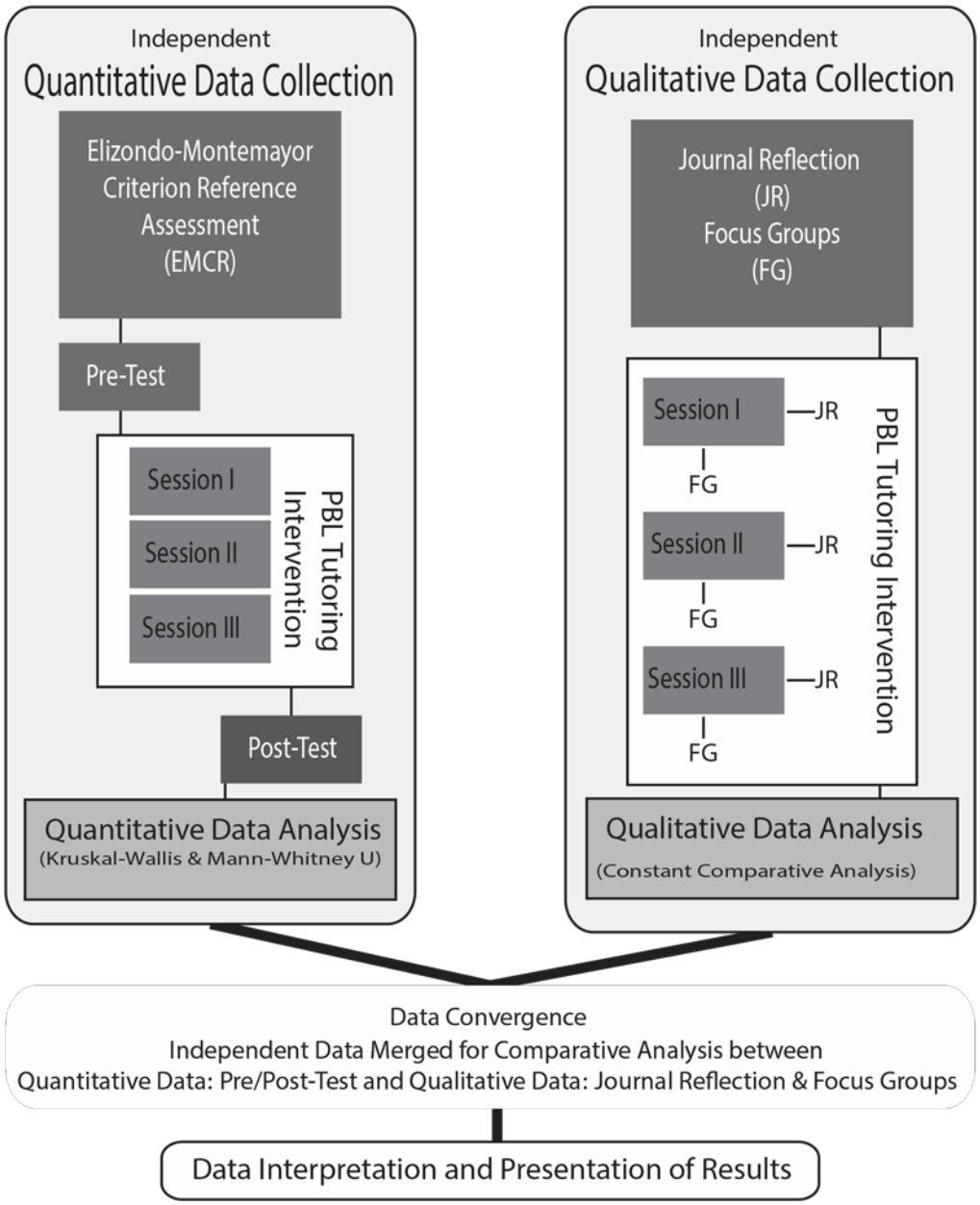


Figure 9 Convergent Parallel Design

Participants

Since 1986, the RU athletic training program has had 53 students receive the Texas Advisory Board of Athletic Training State Licensure, and 31 students have earned the Certified Athletic Trainer credential from the Board of Certification, Inc. At the time of this study, the ATE program at RU had 55 (N=21 Admitted, N=34 Declared) athletic training majors with an established 7:1 ratio for the student to the clinical preceptor. The ATE program had an admitted enrollment of 31 for the spring of 2013. Athletic training students complete seven semesters, totaling 73 hours in athletic training courses, including six semesters of clinical field experience as part of the core curriculum.

The subjects of this field-based study were comprised of a sample of convenience from the undergraduate AT student population at RU. Prospective research subjects within the RU athletic training education program (N=21) received an invitation for participation in March of 2013 (Appendix A). Students responded to the researcher via email indicating their desire to participate in the study. Through the sample of convenience, 15 subjects were randomly selected from the 18 individuals who volunteered for the study. The randomization was performed in Microsoft Excel™ with the top five students selected from the Level-I (N=6) and Level-II (N=7) classes. The Level-III class had 100% volunteerism (N=5). Identifiers for the levels are:

- L-I (First Year Novice-minimum of nine hours of ATTR coursework completed)
- L-II (Second Year Moderate Experience-– 15 hours of ATTTR coursework completed)

- III (Third Year Experienced-greater than 15 hours of ATTR coursework completed).

The sample of students represented all levels within the academic program and comprised the research study group. Table 5 provides a visual representation of the demographics of the study group. The group has an even distribution of novice learners and experienced learners. Ten of the participants were female, five were males.

Student	Sex	Ethnicity	Academic Level	Age Range
1	Female	Caucasian	Level I-Soph	18-19
2	Female	Caucasian	Level I-Soph.	18-19
3	Female	African American	Level I-Soph	18-19
4	Male	Caucasian	Level I-Soph	18-19
5	Male	Hispanic	Level I-Soph	25-30
6	Female	Caucasian	Level II-Junior	19-21
7	Female	Caucasian	Level II-Junior	19-21
8	Female	Caucasian	Level II-Junior	19-21
9	Female	Caucasian	Level II-Junior	19-21
10	Male	Caucasian	Level II-Junior	19-21
11	Female	Caucasian	Level III-Senior	20-23
12	Female	Caucasian	Level III-Senior	20-23
13	Female	Caucasian	Level III-Senior	20-23
14	Male	Hispanic/Native American	Level III-Senior	20-23
15	Male	Caucasian	Level III-Senior	20-23

Table 5 RU Student Demographics

Setting

This study takes place at Regional University (RU) in Texas. Founded in 1891, RU is a coeducational, private liberal arts university and is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools. According to the 2012 enrollment statistics there were 2,358 undergraduate and graduate

students within eight academic schools. Thirty-five bachelor degree programs and 27 graduate degrees across nine programs of study comprise the academic foundation of the University. The Fitness & Sports Science Department, located in the School of Education, is the largest undergraduate program at RU, enrolling 237 students majoring in five areas of study including Athletic Training. The Athletic Training Education Program (ATEP) is a division of the Fitness & Sports Science Department.

RU initiated a National Athletic Trainers' Association approved internship program in 1986. Student interns volunteered their time to study under a nationally certified athletic trainer, and Texas State licensed athletic trainer, commonly referred to as the apprenticeship model in athletic training. Throughout the apprenticeship period, from 1986-2000, Regional University did not have a major or minor in athletic training. The requirements for the internship route to national certification consisted of 1500 clinical clock hours, along with additional athletic training core course requirements. The internship program standards was an addition to the students' major and/or minor studies, and hours accumulated did not count toward their specified major degree field.

In 1998, the Bachelor of Behavioral Science degree in Athletic Training was formally established with the first degrees conferred in the spring of 2000. Further development of the AT degree continued from 2000-2002 with an emphasis placed on recruiting faculty and students in preparation for application as a nationally accredited athletic training education program. The athletic training education program entered candidacy with the Commission on Accreditation of Allied Health Education Programs (CAAHEP) in 2002. Throughout 2003, RU completed the required self-study, with work

culminating in 2004 as the self-study was submitted to the CAAHEP. On April 14, 2005, RU received national accreditation from the CAAHEP; an initial accreditation was awarded for a five-year period. Over the course of the next five years, the National Athletic Trainers' Association established their accrediting body, the Commission on Accreditation of Athletic Training Education (CAATE). In 2010, RU underwent re-accreditation and received a 10-year accreditation status by the CAATE.

The AT program consists of seven semesters over the course of four years. Throughout the length of the program, athletic training students participate in six semesters of clinical field experiences. These field experiences occur in several settings including high school and intercollegiate athletics, orthopedic surgery observation, physical therapy rotation, general medical and physical medicine observations. Each clinical field experience affords the athletic training student a variety of opportunities to practice clinical skills initially introduced and learned within the didactic setting. RU has a unique ATE based upon the extensive clinical experience offering for a rural area of Texas. Universities of similar size within this particular region of Texas do not have the available clinical resources; therefore, the RU athletic training students benefit from a substantial clinical field-based education.

Methods

An intervention is described as a planned set of procedures aimed at educating an individual or group of individuals (Howell & Nolet, 2000). The use of an intervention constitutes an exercise in an activity, or set of procedures, which includes more than one activity, but is not considered a part of the curriculum. Howell & Nolet (2000) describes

an intervention strategy as consisting of several components. The first component consists of planning; an instructional intervention requires data and planning, therefore, the intervention is data based. Second the instructional intervention is sustained and carried out over a course of time. Third, it is targeted or focused on a particular population of students, sets of skills, or to a certain knowledge set. Moreover, lastly, the intervention is goal oriented and is designed to create a changed behavior (Howell & Nolet, 2000).

Nine total PBL tutoring interventions took place over the course of the study during the months of March and April 2013. The participants were comprised of Level-I, II and III students. Level-I represents the novices, whereas Level-III represents the most experienced. Learning groups were comprised of the standard PBL size of five to eight (5-8) students (Lohman & Finkelstein, 2000). The level of academic progress within the program designates the groups. Table 6 illustrates the number of participants per group and their education level.

Group	Level	Number of Members	Completed ATE Hours
Group One	I	5	9-15 hours
Group Two	II	5	15-20 hours
Group Three	III	5	20+ hours

Table 6 Academic Level of Participants
Academic level of participants based on completed ATE hours N=15*Level I=Sophomore, Level II=Junior, Level=Senior

Level-I (novice) ATS experienced basic ATE competencies within the PBL interventions. Level-II (moderately advanced) ATS were subject to ATE competencies

from Level-I and Level-II. Students in the Level-III (advanced) were given comprehensive ATE TR competencies as related to the previous work throughout their time in the ATE program. The PBL tutoring intervention was performed over the course of five weeks. Each academic level (L-I, L-II, L-III) was given a level appropriate PBL-problem. The tutoring intervention provided the following format for implementation by the PBL facilitator: *Introduction to the Problem* –the facilitator read the problem and provided a brief discussion prior to the students beginning their inquiry and discovery period. The introduction to the problem lasted approximately 10 minutes. Students then entered into the *Inquiry/Discovery* Period. During this 45 minute exercise students worked in their learning group to identify what prior knowledge they had concerning the problem. Once previous knowledge had been rocognixed students formulated questions to ask the facilitator during the rebuttal and questioning period. The final step in the intervention was the *Rebuttal Questioning Period* (30 minutes). Throughout this step, student engaged the facilitator with questions regarding the problem. Probing allowed the students to gage whether or not the inquiry/discovery period led them to a proper solution of the problem. The facilitator played the role of "guide" during this phase. The faclitator offered information he/she felt was necessary for the students to solve the problem (Appendix B week 1 problem sets for Levels I, II, & III)

Quantitative Data Collection

Self-Assessments

Langendyk (2006) identifies self-assessment as an essential PBL facet within medical education. PBL implementation requires students to practice self-reflection and

assessment of their ability to successfully navigate real world problems. Supporting Langendyk's notion is the constructivist approach to learning where self-assessment is a product of the learner's ability to build upon old and new knowledge (Zimmerman, 2002). Research by McDonald and Boud (2003) reiterates the need for self-assessment as a successful method to develop learning. Furthermore, Perera, Mohamadou, and Kaur (2009) cite a study by Kaufman (2003) identifying effective learning as the students' ability to engage, critically assess their needs, and identify how to interpret feedback.

The ability of the student to perform self-assessment is another tool lending the development of the life-long learner. Developing a life-long learning attitude requires students to have the ability to take ownership of their learning. Ozogul and Sullivan (2007) believe the use of self-assessment provides greater participation of students when learning takes place. Supported by research performed by De Grez, Valke, and Roozen (2012), McDonald and Boud (2003), Langendyk (2006) and Kaufman (2003). Additionally, the use of self-assessment as a means to scaffold learning creates self-autonomy and guided discovery learning (Langendyk, 2006).

The researcher in this study sought to know how athletic training students assess their abilities to solve problems related to the TR domain in athletic training. Accomplishing this goal required a pre and post-assessment of student self-evaluation in the PLB identified objectives (Elizondo-Montemayor, 2004). Through the use of the self-assessment, students were invited to share the responsibility of assessing their abilities as future athletic trainers. Additionally, a self-assessment allowed the students

to evaluate their behaviors and understanding of the real-world problem faced in athletic training (Grez, Valke, & Roozen, 2012).

Reliability and validity of various PBL assessments. Historically PBL is difficult to assess since it is strategy by which learners gain a holistic approach to the learning process and life skill acquisition within critical thinking, problem-solving/reasoning, self-directed learning, interpersonal social skills and collaborative work (Barrows 1986, 1995; Albanese & Mitchell, 1993; McLoda, 1996; Nedaz Tekian, 1999; Catlaw, 1999; Major, 1999; Elizondo-Montemayor, 2004; Gijbels, Dochy, Van den Bossche, & Segers, 2005; Lesperance, 2008; Belland, French, Ertmer, 2009; Walker & Leary, 2009; Gillette, 2011). Albanese & Mitchell (1993) were the first researchers to perform a meta-analysis on PBL related literature and the effects of PBL. Albanese & Mitchell noted the criteria for assessment as a weakness of PBL implementation, with efforts by various researchers, described as creative and noted to be unreliable and inconclusive (Albanese & Mitchell, 1993). Nendaz and Tekian (1999) performed the second meta-analysis related to PBL assessment noting 16 different assessments used across the literature. “Despite the large range of assessment methodologies used in PBL settings, no single choice emerges, and the triangulation of diverse instruments is required to obtain a fair judgement about students,” (Nendaz & Tekian, 1999 p. 240). Further development of a best practice assessment instrument is needed as no clear assessment was determined to be uniform and accepted across the spectrum of PBL assessment (Nendas & Tekian, 1999). Gijbels, Dochy, Van den Bossche, & Segers (2005) note the implications of assessment are varied based on the goals of the PBL

exercise and due to the variedness of assessment. This creates a moderate variable in determining whether the PBL practice achieved the intended consequences. In 2009, Belland, French, & Ertmer conducted a meta-analysis on the validity and reliability of PBL instruments used to assess learning outcomes. This research examined 33 empirical studies with only four reports providing "interpretable, reliability and dependability coefficients," for all measures of the PBL assessment. Two reports gave coefficients for some measures, and three gave incomplete or uninterpretable evidence on reliability, none of the studies provided score validity (Belland, French, & Ertmer, 2009, p. 78). Belland, French, & Ertmer (2009) also note PBL researchers have inherently neglected the construct of the assessment measures. Overlooking the construct validity of PBL assessments by researchers have led to a vastly inconclusive strategy for proper assessment.

Literature addressing the reliability and validly of PBL assessment is indecisive. To understand this phenomenon the researcher reached out to a PBL assessment expert at Southern Illinois University-Medical School where PBL founder Howard Barrows implemented the PBL practice, which continues to this day. Through personal communication with Dr. Anna Cianciolo (October 6, 2014) she noted PBL assessments have "run along parallel, largely non-overlapping tracks" due to the varying professional areas of research where PBL has been implemented. Researchers have looked specifically at the learning outcomes of PBL for students and have typically relied on multiple choice examinations (MCE) as the assessment tool for measuring outcomes (Cianciolo personal communication, October 6, 2014, Albanese & Mitchell, 1993;

Nendaz & Tekian, 1999; Gijbels, Dochy, Van den Bossche, & Segers, 2005; Belland, French, & Ertmer, 2009; MacDonald & Savin-Baden, 2005).

Cianciolo (personal communication, October 6, 2014) noted the dominate mode of assessment within the medical education community, from which PBL originated, is through multiple choice examinations (Albanese & Mitchell, 1993; Nendaz & Tekian, 1999; Gijbels, Dochy, Van den Bossche, & Segers, 2005; Belland, French, & Ertmer, 2009; MacDonald & Savin-Baden, 2005; Hoon & Gwee, 2003). The use of MCE is a widely accepted assessment tool used in certification exams across many professional disciplines. MCE is the prevailing assessment in medical and allied health education programs as a means to assess learning outcomes (Cianciolo personal communication, Octoboer 6, 2014). MCE offer the advantage of high consistency and reliability as it allows for sampling of broad content areas, as well as high validity if appropriately constructed, (Hoon and Gwee, 2003). Using MCE as the assessment of choice in medical education is directly proportionate to preparing students to take certifying examinations. However the MCE does not specifically test the attributes of PBL as noted in the EMCR (Elizondo-Montemayor, 2004 and Cianciolo personal communication, October 6, 2014).

Cianciolo (personal communication, October 6, 2014) also noted the use of the Objective Structured Clinical Examination Assessment (OSCE,). The OSCE is widely used in the medical and allied health community (Albanese & Mitchell, 1993; Nendaz & Tekian, 1999; Gijbels, Dochy, Van den Bossche, & Segers, 2005; Belland, French, & Ertmer, 2009; MacDonald & Savin-Baden, 2005; Zayyan, 2011, Mitchel et al. 2013).

The OSCE is conducted through a series of simulated patient examinations requiring students to complete various stations where clinical competency is assessed. The main objective is to assess a student's ability to react and engage in a clinical situation, where obtaining/disseminating information, problem-solving, communicating, and handling unexpected behavior is evaluated by a group of supervisors (Zayyan, 2011, Mitchel et al. 2013). The advantages of the OSCE provides uniformity of assessment, availability, safe environment for assessment, tailored problems acted out by simulated patients, demonstration of various knowledge and skills. The disadvantages are based on the need for significant training by faculty and support staff. Textbook scenarios/problems may not provide realistic simulations, and lastly the cost and amount of time to conduct the assessment (Zayyan, 2011, Mitchel et al. 2013). The OSCE was not considered in this study due to the limited resources available to Regional University. Table 7 recognizes common PBL assessments as identified by Albanese & Mitchell, 1993; Nendaz & Tekian, 1999; Gijbels, Dochy, Van den Bossche, & Segers, 2005; Belland, French, & Ertmer, 2009; MacDonald & Savin-Baden, 2005; Grahame & Greg, 95; Kustra, 2002; Rangachair, 2002; Zayyan, 2011; Pell et al. 2013; Mitchell et al. 2013; Major & Palmer, 2001.

Assessment Name	Assessment Type	Positives	Negatives
Multiple-Choice Examination	Summative	Standard measurement for national exams, valid and reliable (MCE)	Does not account for all PBL objectives
Progress Test		True/False Examination assessing content domain knowledge	
Essay Short Answer Problem Analysis Case Base Examination Triple Jump Oral Examination Clinical Reasoning Test	Formative	Application of new knowledge, Critical Thinking, Clinical Reasoning assessed	Missing supportive validity and reliability research evidence indicating all PBL objectives can be assessed
Objective Structured Clinical Examination	Summative/ Formative	Culminating Examination Accounts for all PBL Objectives Assessment can be tailored for both summative and formative assessment. Individual rating scales provide a summative score while open ended questions provide formative scores. Accounts for all PBL Objectives	Cost, Time Consuming, Available Resources Unable to assess all PBL objectives with validity and reliability
Self-Assessment Peer-Assessment Tutor-Assessment			Missing supportive validity and reliability research evidence indicating all PBL objectives can be assessed

Table 7 Common PBL Assessments
(Albanese & Mitchell, 1993; Nendaz & Tekian, 1999; Gijbels, Dochy, Van den Bossche, & Segers, 2005; Belland, French, & Ertmer, 2009; MacDonald & Savin-Baden, 2005; Grahame & Greg, 95; Kustra, 2002; Rangachair, 2002; Zayyan, 2011; Pell et al. 2013; Mitchell et al. 2013; Major & Palmer, 2001.)

Elizondo-Montemayor Criterion Reference Assessment

Dr. Leticia Elizondo-Montemayor, a professor of medicine at Tec de Monterrey, Monterrey, Mexico, saw a need to develop an assessment tool for PBL. Elizondo-Montemayor noted that historically PBL assessments were not focused on the objectives of PBL and the educational objectives within PBL courses, rather PBL assessments were more focused on subjective assessment than objective (Elizondo-Montemayor, 2004).

She began to reflect on the four educational objectives of PBL as identified by Barrows (1986) (L. Elizondo-Montemayor, personal communication, September, 18, 2014). The four objectives of PBL provide students the opportunity to apply knowledge, develop an effective clinical reasoning process, develop self-directed learning skills, and collaborative work (Elizondo-Montemayor, 2004). In 1999, she began work as the lone developer of an innovative formative and summative self-assessment using a criterion reference system for PBL tutoring sessions (L. Elizondo-Montemayor, personal communication, September, 18, 2014).

In 2000-2001, ten pilots/experiments were performed by Elizondo-Montemayor and colleagues over the course of an academic year (two consecutive semesters). Upon the completion of the pilot/experimental trials, Elizondo-Montemayor urged the university to form an assessment committee to develop further the implementation strategy for this new formative/summative assessment. Through her influence, an assessment committee was created consisting of a ten member committee of recognized professors and academic directors within the school of medicine. The committee reviewed the Elizondo-Montemayor Criterion Reference assessment tool and approved the format to be used in all the PBL courses at Tec de Monterrey. Upon approval, the Elizondo-Montemayor Criterion Reference (EMCR) assessment was implemented in approximately 60 courses using PBL. These courses range from first year to forth year medical students at Tec de Monterrey (L. Elizondo-Montemayor, personal communication, September 18, 2014).

According to Elizondo-Montemayor (personal communication, September 18, 2014) the instrument has been used for 14 years. Dr. Elizondo-Montemayor's role changed at Tec de Monterrey and with her departure from one department to another area at Tec de Monterrey, the assessment committee dissolved. To date no quantifiable data have been obtained to establish validity or reliability of the EMCR. However, she did note the EMCR has helped to establish standards of performance for medical students as well as identify students who have difficulty with critical thinking and decisions making skills (Elizondo-Montemayor, 2004, L. Elizondo-Montemayor, personal communication, September, 18, 2014). When questioned if other universities have used or are currently using this instrument, Elizondo-Montemayor stated she has provided the instrument to several universities and researchers over the last 10 years. She does not know if any of the universities implemented this instrument within PBL (L. Elizondo-Montemayor, personal communication, September 18, 2014). Through an exhaustive literature search, no other studies in PBL have acknowledged the use of this instrument.

Professors at Tec de Monterrey have positive reviews of the EMCR and the implementation of the tool. Elizondo-Montemayor stated that she still uses the tool within her PBL courses as do many professors at the University. She did have some push-back from professors who say the instrument is too time consuming and meticulous preferring to assign grades without having any reference criterion (Elizondo-Montemayor, personal communication, September 18, 2014).

The EMCR evaluates the four objectives of PBL: 1) Application of Knowledge, 2) Clinical Reasoning and Decision Making Skills, 3) Self-Directed Learning, 4) Collaborative Work. A fifth objective, Attitude, and Professionalism, was identified by Elizondo-Montemayor as critical for the development of the medical professional. Elizondo-Montemayor developed this assessment to be used as a "flexible" and "adaptable" tool for various PBL courses (Elizondo-Montemayor, 2004). While this assessment can be used for both formative and summative practice, this research utilized the formative method. Dr. Elizondo-Montemayor gave approval for the use of the criterion-referenced system for self-assessment through personal electronic mail correspondence on December 25-26, 2012 (L. Elizondo-Montemayor, personal communication, December 25-26, 2012).

Rationale for the EMCR. The researcher used the EMCR as an exploratory assessment tool for this study since it had originally been designed to assess the primary objectives of PBL. According to Elizondo-Montemayor, no formal reliability or validity of this instrument to date and an extensive literature search has not produced any additional studies using this instrument (Elizondo-Montemayor, 2014 personal communication). This supports the afformentioned research presented by Albanese & Mitchell, 1993; Nendaz & Tekian, 1999; Gijbels, Dochy, Van den Bossche, & Segers, 2005; Belland, French, & Ertmer, 2009; MacDonald & Savin-Baden, 2005. Assessment in PBL should be developed where students and faculty can be open and honest in regards to how learning is taking place within the particular setting (MacDanald, 2005).

MacDonald and Savin-Baden (2004) highlighted the need for PBL assessment to reflect the following principles:

- Based on practice content in which students will work – real or simulated
- Assess professional behaviors reinforced by knowledge, skills, and attitude
- Reflect learners development from beginner to competent practitioner
- Appreciate ongoing assessment by outside entities (ie: clients, colleagues, peers etc...)
- Engage in self-assessment and reflection in the development of self-directed learning practices
- Ensure alignment of assessment with objectives and anticipated learning outcomes.

The EMCR assessment tool aligns best with the principles outlined by MacDonald and Savin-Baden (2004). Dr. Cianciolo noted when assessing the impact of PBL it is right to use a measure, such as the EMCR. The EMCR is conceptually consistent with the goals of PBL, and because of this choice of assessment, there does not exist any validated measures with any other assessment. (Cianciolo, 2014, personal communication).

The EMCR was chosen for this particular study due to its ability to be "flexible" and "adaptable" assessment within PBL (Elizondo-Montemayor, 2004). The flexibility of the criterion reference allows the researcher to design the assessment around the treatment and rehabilitation domain. Using the criterion reference system provides quantifiable data and the integration of focus groups, and personal journal reflection of

the PBL allow for qualitative data. Researching the various methods of assessment for PBL revealed no other university had used this specific tool therefore making this study an exploratory experiment within a PBL tutoring intervention.

The EMCR self-assessment was administered via SurveyMonkey® prior to the first PBL tutoring intervention and after the third PBL intervention. SurveyMonkey® was chosen as the administration medium for the ease of delivery in conjunction with the ability to customize response periods. The use of online survey tools provides a low cost for collection, technical support, assistance to facilitate a greater response rate within specific populations, and database storage (Marra, & Bogue, 2006). Additionally, data retrieved from the online survey had exporting capabilities allowing for advanced statistical analysis. Students within the study had 24 hours to complete the pre and posttest during week two and week five.

Data retrieved from the SurveyMonkey® files were exported to Microsoft Excel where they were stored in an electronic file with password encryption. Original files on the SurveyMonkey ® were deleted to secure the data. Once the data were exported they were organized into the five objective areas of the EMCR PBL assessment:

1) application of knowledge

2) clinical reasoning and decision making skills

3) self-directed learning

4) collaborative work

5) attitude/professionalism (Elizondo-Montemayor, 2004).

Each category has a criterion-referenced rating identifier of 1: Not Developed to 6: Very Well Developed in 50 areas of PBL interest to as it is regarded to in student learning (Elizondo-Montemayor, 2004). Student's individual quantitative results were scored based on the scoring scale developed by Elizondo-Montemayor (2004). Students scoring above 45 points in the five PBL concentrations received an excellent ranking, whereas students scoring below 32 points earned a poor marking (Table 8).

More than 45 points:	Excellent
Between 39-45 points:	Good
Between 32-38 points:	Fair
Less than 32 points:	Poor

Table 8 EMCR Scoring Table
Note. EMCR score range for the five PBL domains (Application of Knowledge, Clinical Reasoning, Self-Directed Learning, Collaborative Work, and Attitude Professionalism)

Pre-assessment took place prior to the beginning of the PBL intervention in week one, with the posttest-assessments taking place at the conclusion of the PBL response in week five. Each assessment was identical to determine the change each student and group experiences throughout the PBL exercises. This information was used to correlate differences between groups and academic levels.

Qualitative Data Collection

Focus Groups

Creswell (2007) notes the use of focus groups as a validated form of collecting insightful information from participants in a study. Focus groups were held in a casual setting allowing subjects to speak candidly about their experiences. The use of focus

groups as a means to gauge participant response is widespread throughout the marketing world (Gibbs, 1997). Over the past 15 years focus group participation in medical education and research have greatly increased (Gibbs, 1997). Focus groups themselves are identified by various definitions including, but not limited to, organized discussions, collective activity, social events, and interactions (Gibbs, 1997, p.1). The overall purpose of focus groups is to allow the researcher to engage participants in discussions otherwise not afforded by interviews, surveys, and observations (Gibbs, 1997). Gibbs (1997) cites the research of Powell, Single, & Loyd (1996) and Morgan (1997) describing focus groups as an assembly of individuals selected by the researcher to discus and comment on personal experiences within the context of the researcher's focus. Bello (2009) identifies the use of focus groups as a "broad appeal" (p. 17) and effective method for research in an assortment of research activities.

Research conducted by Litoselliti (2003) identifies the advantages and limitations of focus groups. Advantages include discovery of new information, various personal and group perspectives on topics, personal values, beliefs, and philosophies, group dynamics, and the ability to explore topics that may be considered complex (Litoselliti, 2003). Conversely, Litoselliti provides the limitations focus groups may encounter such as personal bias and manipulation of the participant, false consensus among group members with more passive personalities who may feel swayed one way or another, identifying group influence vs. individual response, sample size, and difficulty with analysis of open-ended responses (Litoselliti, 2003). These views represented by

Litoselliti (2003) clearly demonstrate the importance of cautiously developing a focus group qualitative assessment.

Qualitative data were collected through nine focus group sessions. Each academic level had three focus group meetings. Focus groups were held one week after each PBL intervention for three weeks. Students participating in the focus group did so voluntarily as part of their agreement with the study. The researcher facilitated each focus group one week after the PBL intervention. All meetings were held on Monday afternoon and evenings. The setting for the focus groups was a conference room in the school of education. Utilizing the conference room promoted an inviting atmosphere where students could gather around a small conference table and interact with one another. The researcher began each focus group session by stating the central and supporting research questions. Sixty-minutes (60) was allotted for focus group meetings. Each focus group session was digitally recorded for data analysis. (Appendix C).

Reflective Journaling

Reflective journaling is the process by which a student records emotions, thoughts, reactions, and ideas regarding a moment in time associated with an event where the student can better evaluate the situation. During this process, the student engages in the practice of critical analysis regarding how he/she may have handled the situation differently. In athletic training education, the practice of reflective journaling is used to engage student learning through classroom experiences, clinical and field

experiences, communication, and personal goals (Walker, 2006). Additionally, subtopics can guide student reflection encouraging a deeper response.

Writing a reflective journal challenges students to deeper thought and evaluation of the problem or situation. Students should reflect on how they would attack a problem or how they would handle themselves if the situation presented itself in the future (Walker, 2006). Additionally, the written journal should allow for the free expression of emotions without the fear of retaliation by the instructor. The entries by students should provide the instructor with insight into the thought process of the student and whether the student can critically analyze a situation and learn from it (Walker, 2006).

Throughout the process of reflection, students should develop a deeper understanding of the situation and how to improve. Leaver-Dunn et. al. (2002) indicate that the use of reflection is what discriminates a novice from a knowledgeable practitioner. The knowledgeable practitioner will recall previous experiences, as well as reflect on the process to advance his/her decision-making skills (Leaver-Dunn et al. 2002). This suggests reflective journaling can enhance the transfer of knowledge and lessen the theory application gap.

Reflective practices have been prevalent in teacher certification programs as well as in other allied health fields. The research presented in pre-service teacher education programs provides a model for the researcher to use in developing the reflective practice desired of the athletic training student as he/she engages in learning and the transfer of knowledge. Maarof (2007) describes the process of reflection as how the students view themselves against a seasoned practitioner. The study conducted by Maarof (2007)

revealed all 30 of the participants believed reflective journaling aided their pre-service experience in teaching. Participants indicated reflection allowed them to recognize strengths and weaknesses in their teaching ability, helping them to make corrective changes for future application (Maarof, 2007). Maarof's study provides evidence for the use of reflective journaling. This study also allows the researcher to explore how students identify their strengths and weaknesses related to PBL and whether the theory application gap decreases for students.

Implementation of reflective journaling is not a new practice for the students participating in this study. Currently, students in the RU ATEP complete a bi-monthly electronic journal for their field experience courses. Reflective journals were submitted through the Wufoo™ Form Builder. A link was emailed weekly to students to complete the reflective journal. Students had seven days to complete the entry as they reflected on the weeks PBL intervention. Students were allowed to engage in as much reflection as they desired. Some students practiced creative writing, while other students merely completed the task, offering little reflection at all. The use of the WuFoo™ form builder allowed the researcher to administer the reflective journal using a web-based tool for ease of accessibility and collection. Students received a weekly e-mail link indicating the "PBL-Tutoring Intervention Reflective Journal" was active. The journal remained open for one week allowing students to work at their pace when reflecting. Each journal response was collected via the WuFoo™ form builder and then exported into Microsoft Word document format for analysis. All journal entries were saved through encrypted password on the researcher's computer.

Data Analysis

Creswell & Plano-Clark (2007) note convergence of data as the preferred method among novice mixed-method researchers. Mixed-methods is efficient as traditional data collection and analysis is performed within the individual data set then triangulated at the conclusion of the data analysis. According to Ostulund et al. (2011) the use of triangulation is to determine if an association is understandable between the theoretical and practical evidence produced in a study. Additionally the use of triangulation is a preferred method used in medical research. and allied health professionals may be able to determine better and understand the link between theory and application (Ostulund et al. 2011). The use of a convergent parallel design allowed for quantitative data and qualitative data to be collected, analyzed independently and then triangulated at the time of data analysis (Angell & Townsend, 2011).

Data were collected separately, with the converging of data occurring at the conclusion of the study (Creswell, 2010). Quantitative assessment occurred in the form of student self-assessments identifying how students score themselves regarding the five PBL objectives as outlined by Elizondo-Montemayor (2004).

The quantitative assessment used the Elizondo-Montemayor Criterion Reference (EMCR) PBL Objective Self-Assessment as the Pre/Posttest quantitative tool. The EMCR pre-test assessment was performed prior to the beginning of the study, whereas the posttest was conducted at the conclusion of the last PBL problem set. Qualitative data was collected through focus group participation and reflection journals throughout the course of the study.

This contemporaneous data were used to gauge the athletic training student's perceptions of PBL as it relates to an effective instructional strategy for reducing the theory application gap. The overall rationale for this mixed-methods approach is to compare the quantitative (indicating what the subjects learned) and qualitative results (resulting in the subjects feelings towards the PBL process). Using the data from the mixed-methods approach will assistn in determining if a tutoring intervention in PBL is suitable to use as an instructional strategy for reducing the theory application gap in the TR domain. Table 9 demonstrates the timeline of the study.

Level-I	Week 1	Week 2	Week 3	Week 4	Week 5
PBL Study Introduction	X				
EMCR PBL Pre Assessment		X[Quan]			
PBL Intervention		X	X	X	
Problem 1: Wound Care		X			
Problem 2: AC Joint			X		
Problem 3: Patella Tendon Rupture				X	
PBL Focus Group			X[Qual]	X[Qual]	X[Qual]
PBL Reflective Journal			X[Qual]	X[Qual]	X[Qual]
EMCR PBL Post Assessment					X[Qual]
Level-II	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**
PBL Study Introduction	X				
EMCR PBL Pre Assessment		X[Quan]			
PBL Intervention		X	X	X	
Problem 1: Low-Back Pain		X			
Problem 2: ACL Reconstruction			X		
Problem 3: Ankle Surgery				X	
PBL Focus Group			X[Qual]	X[Qual]	X[Qual]
PBL Reflective Journal			X[Qual]	X[Qual]	X[Qual]
EMCR PBL Post Assessment					X[Qual]
Level-III	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**
PBL Study Introduction	X				
EMCR PBL Pre Assessment		X[Quan]			
PBL Intervention		X	X	X	
Problem 1: Professionalism/Conflict		X			
Problem 2: Osteitis Pubis			X		
Problem 3: Peroneal Nerve/Knee				X	
PBL Focus Group			X[Qual]	X[Qual]	X[Qual]
PBL Reflective Journal			X[Qual]	X[Qual]	X[Qual]
EMCR PBL Post Assessment					X[Qual]

Table 9 PBL Intervention Timeline

Note. Quantitative Assessment = Quan, Qualitative Assessment = Qual *quantitative assessment used the EMCR self-assessment, qualitative assessment used focus groups and reflective journals

Quantitative Data Analysis

Kruskal-Wallis statistical analysis was used for quantitative analysis using the PASW Statistics (formerly SPSS) program. The Kruskal-Wallis one-way ANOVA known as an H test used to test three or more independent groups. Groups may be the same or different in variables of ordinal, interval, or ratio level of data. Kruskal-Wallis one-way ANOVA assesses whether the distribution is the same for the samples. The H test advantage allows for an easier understanding of data and makes fewer assumptions about the study groups. Additionally, the use of the H test can be used to answer all the questions within the hypothesis by replacing actual data collected in the criterion reference assessment and ranking the data. Ranking the data creates simplified calculations, and general assumptions are made concerning the distribution (Chan & Walmsley, 1997).

The decision to use the Kruskal-Wallis one-way ANOVA was based on the ability of the ANOVA to test three or more independent groups. This study suggests assessing the Level-I, Level-II, and Level-III ATE students at RU. Each group underwent the same PBL intervention, the only exception being the competencies presented through the interventions. Additionally, the testing groups received the same criterion referenced-assessment as a pre- and post-test. This design aligns with the use of the Kruskal-Wallis one-way ANOVA (Chan & Walmsley, 1997).

Following the Kruskal-Wallis analysis a post-hoc Mann-Whitney U analysis was performed to analyze where the differences lie between the means of the paired PBL objectives and the academic levels. Due to running multiple comparisons, a *p* value of

0.025 had to be used when comparing the individual PBL objectives and academic levels with one another, therefore reducing the chance for statistical significance to be found.

Qualitative Date Analysis

Creswell and Plano-Clark (2011) describe qualitative analysis through data coding, thematic grouping, labeling of codes, interrelating themes, and using qualitative software programming. Data received via qualitative collection followed a variation of the steps outlined by Marshall and Rossman (2006): organization of the data corpus, immersion of the data (reading), coding of the data as it relates to the research questions followed by the creation of sub-themes and themes, interpretation through analytic memos relating the data back to the research questions and literature review, and lastly the creation of the data narrative where triangulation of the data occurs through the connections of the themes with the connections of the research questions and literature. Each step will be discussed in brief.

Organization of Data

Organizing the data was the first step in the analysis. Qualitative data was collected over the course of the three-week study using focus groups transcripts and individual reflective journaling. The primary qualitative source came from focus group participation with the secondary source of data from student reflection journals (50% response rate 24/48 journals returned). The researcher can assume the 50% response rate was due to the fact students did not perceive the importance of the reflective journal and, therefore, elected not to complete their journal entries. Focus groups were held for each academic level one week after the introduction of the PBL tutoring intervention and

students recorded weekly reflection journals between the tutoring session and the focus group.

Six hours of focus groups were digitally recorded and later transcribed verbatim, making sure to omit common language and slang. Digital recording was conducted using Apple, Inc., GarageBand software and files were categorized into three separate focus groups for each level. The digital recordings were kept in a password protected file on the researcher's personal computer.

The raw .aiff audio data was converted to a .mp3 file and transcribed using the Microsoft Word 2013 word-processing software. Data transcription was organized in a continuous manner for each academic level and saved under different file names (Table 10) Data from the reflection journals was collected through WuFoo Forms, an online form builder collection site. Raw data from the reflection journals was converted from .html to .pdf files.

After the transcription of the focus group data was complete, the data were formally organized for analysis and interpretation using a qualitative data analysis spreadsheet created by the researcher using Microsoft Excel 2013 (Figure 10).

	Raw Audio Files			Transcribed Files	WuFoo Form Files	Analysis Files
	FG Week 1	FG Week 2	FG Week 3	Focus Groups	Reflection Journals	Excel Spreadsheet Workbook - Worksheets
Level I	L1-FG1.mp3	L1-FG2.mp3	L1-FG.mp3	L1-FG.docx	L1-RJ.pdf	masterQu.xlsx - L1FG, L1RJ, L1STh
Level II	L2-FG1.mp3	L2-FG2.mp3	L2-FG3.mp3	L2-FG.docx	L2-RJ.pdf	masterQu.xlsx - L2FG, L2RJ, L2STh
Level III	L3-FG1.mp3	L3-FG2.mp3	L3-FG3.mp3	L3-FG.docx	L3-RJ.pdf	masterQu.xlsx - L2FG, L3RJ, L3STh

Table 10 Qualitative Data Organization
Note. L1=Level 1, L2=Level 2, L3=Level 3, FG=Focus Group, RJ=Reflective Journal, STh=Sub-Themes

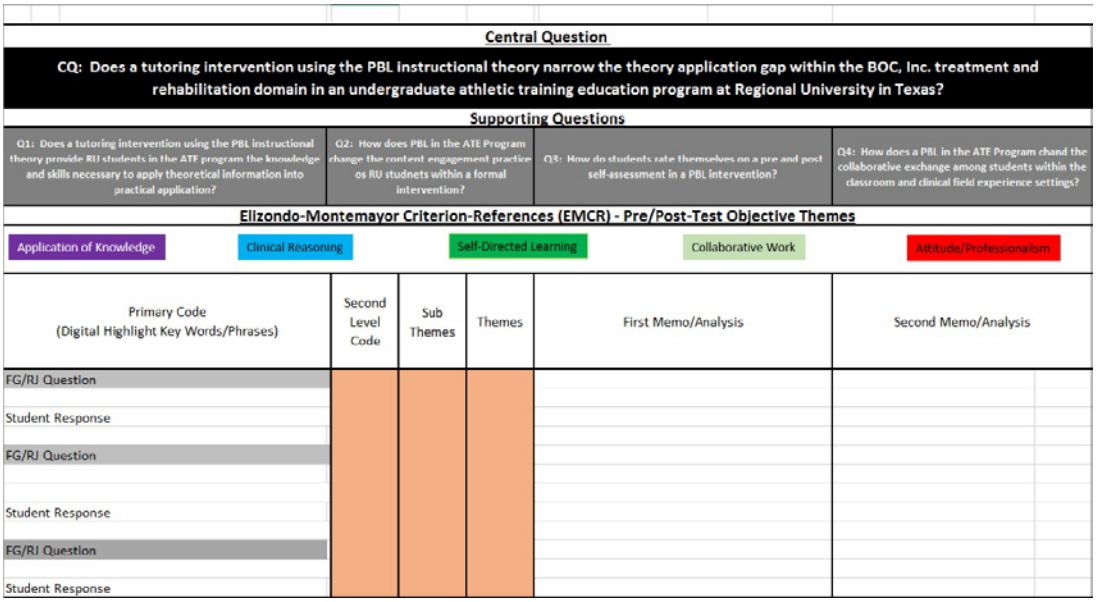


Figure 10 Qualitative Analysis
Note. Spreadsheet developed by the researcher.

The central research question was placed as a header for the workbook. Directly beneath the central question were the four supporting questions, providing the researcher with a constant reminder of the research questions. Below the central and supporting questions were the five EMCR objective themes. The five assessment categories used in the EMCT pre/post-test were the guiding themes for the qualitative analysis. Therefore, the five themes were placed under the sub-questions. Further data organization consisted of the transcription text placed in the column with the heading "first-level codes", followed by the column entitled second level coding, the next column is where sub-themes were identified, the next column provided the alignment of themes as relating to the EMCR. Analytic Memo/analysis followed the same formatting, and served as the area for first analytic memo/analysis relating the data back to the supporting research questions, with the far right column serving as the second memo/analysis area where the data were correlated to the literature review. The transcribed focus groups were copied from Microsoft Word 2013 into Microsoft Excel 2013. Data from the reflection journals were exported from .pdf to a Microsoft Excel .xlsx file. The data was cut and pasted into the qualitative data analysis tool. This process was conducted for each academic level within the spreadsheet workbook. This organization allowed the research to move easily through the tabs within the workbook for data interpretation and analysis.

Each line of data was represented in a single row within the spreadsheet, which included text wrapping to allow the text to remain in one cell for ease of reading and analysis. A blank row was left between each cell of data for the continued organization. Finally, all question fields were shaded gray to provide organizational separation of the twelve focus group questions. All three focus group (for each level) transcripts were associated with a single sheet within the workbook (Figure 11).

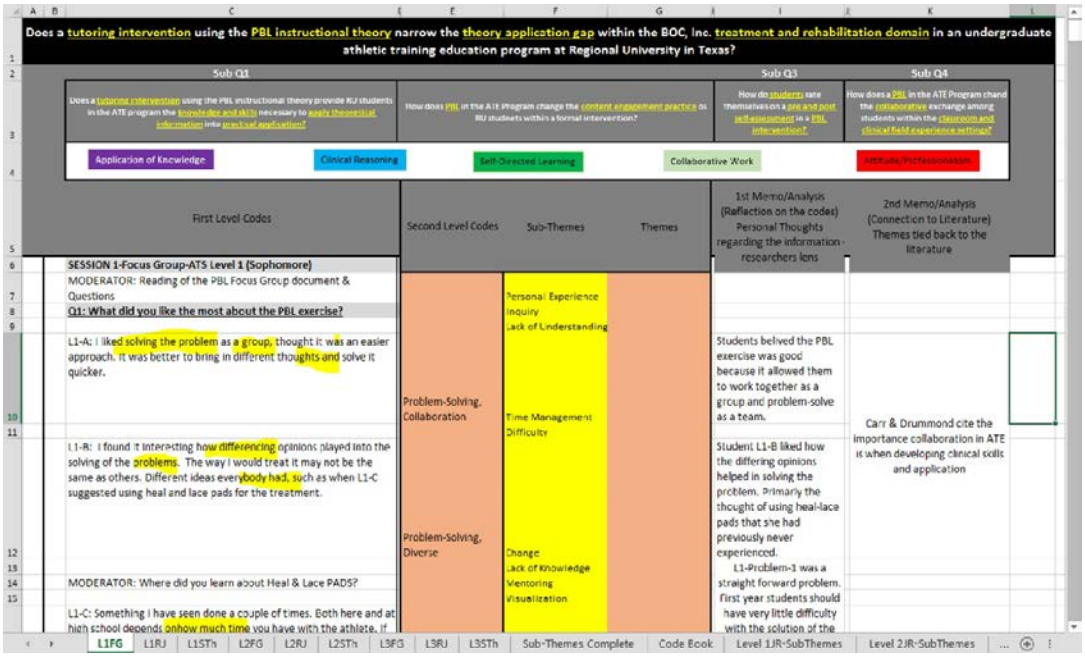


Figure 11 Organization of Data
Note: Qualitative data analysis workbook with tab organization for each level of student studied. L1FG = Level I Focus Group, L1RJ = Level I Reflection Journal, L1STh = Level I Sub-Themes

Immersion of the Data

Once the data were organized within the spreadsheet, the researcher began a thorough reading of the data. The first reading of the data corpus was to become more familiar with the data. The second and third readings consisted of listening to the original raw audio files while reading along with the transcripts.

Coding of the Data

The five objectives of the EMCR were pre-selected as the central themes for qualitative data analysis. Through an extensive literature review on the EMCR and personal communication with Dr. Elizondo-Montemayor, the researcher discovered the EMCR did not have a record of qualitative analysis. This led to the selection of the five PBL objectives serving as the central themes for qualitative data coding. Saldana (2013) classifies this form of pre-selected coding as Holistic Coding. Holistic coding is a foundation process whereby data is first identified as a whole prior to a first or second round of coding. Coding of this nature is appropriate for multiple sources of qualitative data for which this research obtained focus group and reflective journal entries. Furthermore, holistic coding is relevant when the researcher has already established the area of investigated interest. Lastly, holistic coding is considered more applicable to data that is represented self-standing units (Dey, 1993 as cited in Saldana, 2013). In the case of this study, the researcher established area of investigation was the *application of knowledge, clinical reasoning, self-directed learning, collaborative work,* and *attitude and professionalism.* Analyzing the data is then defined by these pre-established themes prior to refining through first and second level coding (Saldana, 2013).

Saldana (2011) describes coding of data as a "method of discovery" (p. 95). It is through this method of discovery that "these coded function as a way of patterning, classifying, and later organizing each datum into emergent categories for further analysis (Saldana, 2011, p. 95). The process of coding allows the researcher to give a "name" to the data as they are presented. As noted by Saldana (2009) a code is "most often a word or short phrase that assigns a summative, essence capturing attribute for a portion of language or visual data" (p. 3).

Throughout the coding process, various methods can be used to assist in differentiating various trends in the data text. Preliminary coding consisted of process coding where the researcher was capturing action within the data. Process coding is identifying portions of the interview where action words can be applied to identify or "name" the text pattern (Saldana, 2011). During the fourth reading first level codes were identified by digitally highlighting key words and phrases. This was performed on a Dell Latitude XT2 Tablet/PC using the digital stylist to highlight the key words and phrases. Once the first level codes were formulated for each level, the researcher when back and re-read, the data corpus noting any missing words or phrases. An example of this can be seen in Figure 12. In this example the phrase "…what we do believe and think we believe…" was identified as a first level code. First level coding was conducted throughout all focus group data and reflective journal data prior to beginning second level coding.

Q9: Describe how you the PBL exercise relates to your clinical practice.
L3-A: Now, still in the phase of learning what we do believe and think we believe. We are growing in knowing what I do need to do formulate my opinions and how I can show other my opinion and why I believe the way I do based on evidence.

Figure 12 First Level Coding
Note. Digital Highlights of key words and phrases

A second round of coding took place where the process codes were categorized into similar clusters (Saldana, 2011). Some codes can be interchangeable between clusters. The researcher started with Level-I data first and progressed through the focus groups/reflective journals for each level. During the process of second level coding, reflection was given for each word and/or word phase to identify a specific "code word/word phrase" that accurately names the raw data. Using the same data example previously discussed, Figure 13 illustrates how the raw data phrase was coded as learning, cognitive process, metacognition, and opinion. The specific codes were assigned based on the researcher's reflection of the data.

Once all focus groups and reflective journals received their second level coding, the text was extracted to another worksheet within the workbook where further analysis of sub-themes could take place. Sub-thematic coding took place for each level focus group and a reflective journal. The data were organized alphabetically then counting of

the code frequency began. Each word was added individually according to the number of times it appeared in the second level code (Figure 14).

A total of 268 (n=268) individual codes were identified at the completion of the second level coding. Further data analysis identified 125 (n=125) recurring sub-themes. These recurring sub-themes were identified by having >2 times reoccurrence. For instance, Problem-Solving was coded 82 (n=82) times across all levels whereas WhatYouSeeIsWhatYouGet (WYSIWYG) was coded twice (n=2). In order to narrow down the 125 (n=125) recurring sub-themes the data from each level was analyzed further. Each level of data had its sub-themes identified using the same methodology above (Figure 14). Completing the sub-theme analysis for each level allowed the researcher to cross-reference the recurring data from each group compared to the data corpus. Data from the each level was cross-referenced with the data corpus. Themes that had a value >6 were selected as this provided a more accurate representation of narrowing the data corpus. The final sub-theme identification narrowed the 125 (n=125) down to the 34 (n=34) as seen in Figure 15 and Figure 16. Through the constant comparative method of analysis, as presented previously, the following sub-themes emerged from both qualitative data sources and are presented in Figure 17

Q9: Describe how you the PBL exercise relates to your clinical practice.	
L3-A: Now, still in the phase of learning what we do believe and think we believe. We are growing in knowing what I do need to do formulate my opinions and how I can show other my opinion and why I believe the way I do based on evidence.	Learning, Cognitive Process, Metacognition, Opinion,

Figure 13 Second Level Coding

Level 2 - Focus Group Codes

Second Level Codes		Sub-Themes	
Adovate	1	Cognitve Process	27
Advocate	2	Time Management-More Time	24
Advocate	3	Metacognition	20
Advocate	4	Dispotions	19
Ah-Ha Moment	1	Frustration	16
Ah-Ha Moment	2	Collaboration	13
Alienated		Lack of Understanding	12
Ambiguous		Communication-Written	11
Application		Research	11
Assurance		Lack of Communication	10
Awareness	1	Critically Thinking	9
Awareness	2	Problem-Solving	9
Best Effort		Understanding	8
Big-Picture		Hands-On Learning	7
Brainstorm		Confidence	6
Brainstorming	1	Differentiation	6
Brainstorming	2	Difficulty	6
Brainstorming	3	Diversity	6
Brainstorming	4	Procedural Process	6

Figure 14 Sub-Theme Calculation

.

	F	G	H	I	J	K
1						
2	Level 1-Focus Group Themes		Level 2-Focus Group Themes		Level 3-Focus Group Themes	
3						
4	Prior-Knowledge	17	Cognitve Process	27	Research	21
5	Research	16	Time Management-More Time	24	Problem-Solving	18
6	Cognitive Process	16	Metacognition	20	Practice	18
7	Metacognition	15	Dispotions	19	Cognitive Process	14
8	Problem-solving	11	Frustration	16	Metacognition	10
9	Procedural	11	Collaboration	13	Differentiation	9
10	Collaboration	9	Lack of Understanding	12	Critical Thinking	8
11	Previous Experience	8	Research	11	Individual	8
12	Divsersity	8	Communication-Written	11	Procedural Process	6
13	Visualization	6	Lack of Communication	10	Diversity	6
14	Evidence	7	Problem-Solving	9	Communication-Written	11
15	Practical Application-Lab	8	Critical Thinking	9		
16	Communication-Written	8	Understanding	8		
17	Lack of Knowledge	6	Hands-On Learning	7		
18	Change	6	Procedural Process	6		
19	Mentoring	6	Differentiation	6		
20			Diversity	6		
21			Difficulty	6		
22			Confidence	6		

Figure 15 Sub-Themes
Note. Identified sub-themes per level, >5 reoccurring sub-themes were considered.

D	E
Sub-Themes Identified = 34	Total Represtations
Problem-Solving	82
Research	77
Cognitive Process	72
Collaboration	68
Procedural Process	62
Metacognition	51
Critical Thinking	37
Differentiation	32
Prior Knowledge	32
Understanding	24
Disposition	23
Frustrated	23
Individual	23
Prior Experience	23
Diversity	22
Lack of Information	20
Inquiry	18
Difficulty	16
Focused	16
Lack of Understanding	16
Ah-Ha Moment	15
Discussion	12
Hands-On Learning	12
Lack of Communication	12
Compromise	11
Confidence	11
Visual Learning	11
Evidence	10
Lab	10
Communication-Written	9
Lack of Knowledge	9
Changed	8
Time Management-More Time	8
Mentor	7

Figure 16 Final Sub-Themes

Figure 17 Codebook of Theme

Note. Major themes were identified through the EMCR Self-Assessment and sub-themes emerged as a result of process coding the focus group and reflective journal transcripts. All but four sub-themes emerged from both the focus group and reflective journals. Compromise, Discussion, Inquiry, and Lack of Information were the only sub-themes identified solely from the reflective journals.

Relating the Data to the Research Questions

The next step in analyzing the data was to review each source and reflect using the analytic memo writing technique. Analytic memo writing allows the researcher to reflect specifically on the data and write about how the data reveals itself within the study. Analytic memo writing was performed for the FG transcripts, and a cross case analysis was used to analyze the reflective journals from across all three academic levels.

The final step in the qualitative methodology is to the creation of themes. Themes presented in the ELMCR pre/post-test were used to categorize the data. These five themes indicated 1) A student's application of knowledge, 2) a student's clinical reasoning and decision making skills, 3) a student's ability to be a self-directed learner, 4) a student's ability to work collaboratively, and 5) a student's attitude and professionalism.

Emerging themes, using the constant comparative analysis, for the focus groups and reflection journals evolved lending themselves to support the five PBL objectives as assessed through the EMCR. These five objectives became the central themes for the qualitative findings. The EMCR PBL objectives were used based on their alignment to the PBL educational objections researched by Barrows (1986). Qualitative data findings were collected with two methods, focus groups and reflection journals. Each focus group met face-to-face with the researcher one week after the PBL tutoring intervention. While at the same time, during the week after the PBL intervention, students completed a reflective journal entry.

The data were converged after both the quantitative and qualitative interpretations had been completed. Each data set was reviewed to determine similarities and how the two converge into a single supporting data set.

Limitations

This research study has several limitations within the design. To extrapolate and identify the limitations the following areas of concern are noted:

L1. A limitation of this study was the researcher. The researcher was the Head Athletic Trainer at RU and served as a clinical preceptor directly supervising eight of the 20 subjects during the spring of 2013-study period. The researcher had to be aware of the personal bias that may hinder the outcome of the study. In order to avoid a personal bias, during the six-week testing period, the researcher relinquished daily supervisory roles to a graduate assistant athletic trainer. These duties included specific clinical instruction within the Central Sports Medicine Clinic at RU. During the spring 2013, the researcher's supervisory roles were only with pre-admitted athletic training students who were in their first semester of the ATE program. These students were not involved in the study.

L2. The study took place in a single athletic training education program setting with a small sample size. The results of the study may not be applicable to the general AT community as it relates specifically to the treatment and rehabilitation domain within this specified ATEP setting.

L3. There was no way for the researcher to control students' prior academic performance such as previous experience with various instructional and learning strategies, as well as any documented learning disability.

L4. This study was isolated to PBL instruction specific to one domain of athletic training education. The results may suggest PBL does not allow the adequate transfer of knowledge from the perception of the athletic training student; therefore PBL may be a more effective strategy for another domain of athletic training.

L5. This study was only conducted over the course of a five-week period with three weeks of PBL tutoring intervention. Therefore, the lack of time devoted to the developing of problem-solving skills may have affected the outcome of the study.

L6. This study was conducted during the final eight weeks of the spring semester. Students participating mentioned periodically their participation in the study caused stress as they also had to pay attention to their end of the semester/academic year projects and tests.

L7. The researcher served as the facilitator of the focus groups. This participation could have given student participants the impression they could not speak as freely as they would like. The researcher made it clear to be as honest as possible; however, his presence as facilitator may have hindered responses.

L8. The EMCR assessment was used as an exploratory instrument for this study. Previous use of the EMCR was limited to Tech de Monterrey courses with no evidence of validity or reliability.

L9. Research indicates the PBL community does not ascribe to any one valid or reliable assessment tool, therefore making this study open to scrutiny through the use of the EMCR assessment as an exploratory instrument.

Qualifications of the Researcher

The researcher holds both undergraduate and graduate level degrees in Physical Education and is a Texas Advisory Board of Athletic Training Licensed Athletic Trainer, and a Board of Certification, Inc. Nationally Certified Athletic Trainer. Currently, the researcher for this study is an Assistant Professor of Fitness & Sports Science and Clinical Education Coordinator at Regional University. He previously served as the Head Athletic Trainer and CAATE Approved Clinical Preceptor at RU. While serving as the Head AT, the researcher had daily interaction with one-third of the AT student population within the sports medicine clinic he directed. This contact with AT students served as a clinical education forum and setting to perform skills integration in a controlled patient population of intercollegiate student-athletes under direct clinical supervision.

CHAPTER IV

PRESENTATION OF THE DATA AND FINDINGS

Background

This mixed-methods study aimed to answer the central research question: How does a tutoring intervention in PBL narrow the theory application gap within the BOC, Inc. treatment and rehabilitation domain in an undergraduate athletic training education program at Regional University in Texas? The sub-questions of this research study were:

Q1: Does a tutoring intervention using the PBL instructional theory provide RU students in the ATE Program the knowledge and skills necessary to apply the theoretical information into practical application?

Q2: How does PBL in the ATE program change the content engagement practices of RU students within a formal tutoring intervention?

Q3: How do students rate themselves on a pre and post self-assessment in a PBL intervention?

Q4: How does a PBL intervention in the ATE program change the collaborative exchange among students within the classroom and clinical field experiences settings?

To answer these questions, the researcher used the constructivist framework. Learners practicing constructivism gain knowledge through a variety of methods, including hands-on learning, discovery, and personal connection (Hendry, 1999). Educational theorists Dewey, Bruner, Piaget, and Vygotsky postulated that the constructivist approach to learning enhances critical thinking, problem-solving, and transfer of knowledge through connections. PBL uses real-world problems to develop learning relationships to the theoretical content, bridging the theory application gap. This student-centered approach to learning aligns with Howard Barrows' primary strategy for developing problem-based learning. Problem-based learning occurs through problem-solving while engaging the learner to search beyond the given information producing depth and complexity of knowledge (Dochy et al. 2003, Duffy & Jonassen, 1992).

Methodology and Methods Summary

Methodology

Creswell (2011) states mixed methods must provide a real-world approach for the researcher. Utilizing the real-world approach to collecting data supports the application of PBL as the researcher looks to address the issue of the theory application gap in ATE.

The use of mixed methods research in allied health fields has been successful in providing greater autonomy for practice (Ostlund, Kidd, Wengstrom, Rowa-Dewar, 2011). Employing the convergent parallel design has shown an improved understanding of theory and empirical findings (Oslund et al., 2011). This combination of the data sets, quantitative and qualitative, provides the research an avenue to disseminate the connection between concepts and application (Oslund et al., 2011, Rauscher & Greenfield, 2009).

The convergent design mixed method (Figure 18) was used to obtain different data sets on the same topic (Creswell & Plano-Clark, 2011). Ostlund et. al. (2011) indicate triangulation as a means to draw an association between the theoretical and evidence produced by mixing the methods of data. Furthermore, Ostlund et. al. (2011) recommend the use of the triangulation model in medical research to increase a linkage between theory and application of the methods. This requires transparency of the researcher and the careful execution of the methods in order to articulate the researcher's intent.

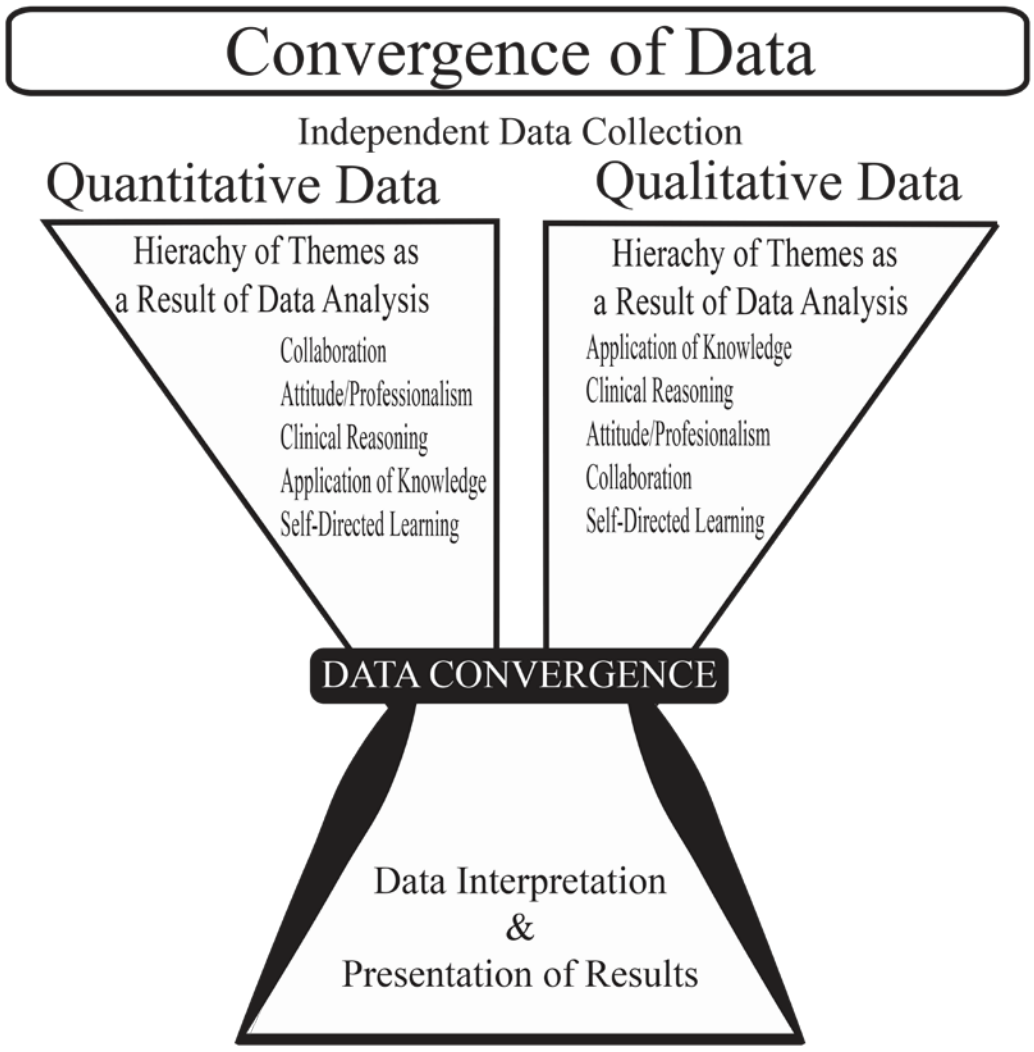


Figure 18 Convergent Mixed-Methods Design.
Note. This figure illustrates the independent data collection followed by the convergence of the data performed in data analysis.

Methods

Prospective research subjects within the RU athletic training education program (N=21) received an invitation for participation in March of 2013 (Appendix B?). Students responded to the researcher via email indicating their desire to participate in the study. Through a sample of convenience, 15 subjects were randomly selected ou of the 18 individuals who volunteered for the study. The randomization was performed in Microsoft Excel™ with the top five students selected from the Level-I (N=6) and Level-II (N=7) classes. The Level-III class had 100% volunteerism (N=5). Identifiers for the levels are: L-I (First Year-Novice) L-II (Second Year Moderate-Experience) and L-III (Third Year-Experienced).

Each level met independently with a facilitator once a week for three weeks. The L-I facilitator was a novice clinical instructor of athletic training education with one year of clinical experience. The L-II facilitator had six years of clinical instructor experience, and the L-III facilitator had 16 years of clinical experience. All study groups met on Tuesday evenings for 90-minute sessions Level-II and Level-III at 5:00 PM and Level-I at 7:00 PM.

The PBL tutoring intervention was performed over the course of five weeks. Originally the study was to take place for seven weeks, but a modification had to be made due to participant conflicts and schedules. Each academic level (i.e., L-I, L-II, L-III) was given a level-appropriate PBL problem as depicted in Chapter II-Table 6.

The tutoring intervention format provided the following organization for implementation by the PBL facilitator: *Introduction to the Problem* –the facilitator, read

the problem and provided a brief discussion prior to the students beginning their inquiry and discovery period. The introduction to the problem lasted approximately 10 minutes. Students then entered into the *Inquiry/Discovery* Period. During this 45 minute exercise students worked in their learning group to identify what prior knowledge they had concerning the problem and then recognized items they did not know to formulate questions to ask the facilitator during the rebuttal and questioning period. The final step in the intervention was the *Rebuttal Questioning Period* (30 minutes). Throughout this step, a student engaged the facilitator with questions regarding the problem. Probing allowed the students to gauge whether the inquiry/discovery period led to the proper solution to the problem. The facilitator played the role of "guide" during this phase, offering information he/she felt was necessary for the students to solve the problem.

Data Analysis

Quantitative Data Analysis

The Elizondo-Montemayor Criterion-Reference (EMCR) for self-assessment in PBL developed by the medical school Tec De Monterrey (Appendix C) was used as the pre and posttest quantitative instrument. Specifically the EMCR evaluated five objectives of PBL: 1) Application of Knowledge, 2) Clinical Reasoning and Decision Making Skills, 3) Self-Directed Learning, 4) Collaborative Work, and 5) Attitude and Professionalism (Elizondo-Montemayor, 2004). Scoring of the EMCR was calculated by evaluating the mean of each PBL objective area and determining a score based on the scoring table.

Student's individual quantitative results were scored based on the scoring scale developed by Elizondo-Montemayor (2004). Students scoring above 45 points in the five PBL concentrations received an excellent ranking, whereas students scoring below 32 points earned a poor marking.

Data were exported from SurveyMonkey® and initially organized in Microsoft Excel where descriptive statistics was performed. Once the descriptive analysis was complete, the data were exported for advanced statistical analysis using the PASW statistical package. Advanced statistics performed on the EMCR included the Kruskal-Wallis statistical analysis identifying any statistical significance by comparing the three groups, followed by the Kruskal-Wallis analysis and a posthoc Mann-Whitney U analysis, performed to analyze where the differences lie between the means of the paired PBL objectives and the academic levels.

Qualitative Data Analysis

Qualitative analyzes were performed through holistic and process coding of the data sources. Creswell and Plano-Clark (2011) describe qualitative analysis through coding of the data, thematic grouping, labeling of codes, interrelating themes, and using qualitative software programming. Furthermore, Saldana (2011) describes coding of data as a "method of discovery" (p. 95). As noted by Saldana (2009) a code is "most often a word or short phrase that assigns a summative, essence capturing attribute for a portion of language or visual data" (p. 3).

The EMCR pre/post-test self-assessment evaluated how students rate themselves within a PBL intervention. These five objectives of PBL assessed by the EMCR were

Application of Knowledge, Clinical Reasoning, Self-Directed learning, Collaborative Work, and Attitude/Professionalism. The PBL objectives from the EMCR assessment were used as the major themes for qualitative data analysis. Qualitative data were collected using focus groups and reflective journaling (50% response rate - 24/48 journals returned) throughout the course of the study.

Quantitative Results

The quantitative data presented in this section provide the statistical data of the EMCR PBL pre and post self-assessments. This data are presented prior to the qualitative data to provide statistical analysis within the five EMCR PBL objectives assessed. Presenting the quantitative data first allows the researcher to demonstrate the areas of statistical significance. In the qualitative data results section, data are presented to show student reaction to the PBL intervention and to substantiate or refute the quantitative data.

The sample of volunteers (N=15) for this study is small due to the overall ATE program admission numbers. During the course of this study there were 31 students enrolled in ATE program; however only 21 students were eligible to participate. Subject participation was designed for 15 student volunteers within the three academic levels, allowing for up to five (5) volunteers per level. The remaining 10 students were first-semester freshmen and/or transfers who did not meet the academic requirement for participation as a volunteer (completion of at least 6 hours of ATE courses). The results presented in this section provide descriptive and advanced statistical analysis for the quantitative measures of this mixed methods study.

Level-I Results

Level-I students are novice learners and represent dualism moving towards multiplicity positions as theorized by Perry (Evans et al. 201). Students still wrestle with understanding and appreciating others opinions as well as developing an understanding of their own opinions. Critical thinking has not been mastered as the student still rely on the "right vs. wrong" approach presented by authority figures. This demonstrates the core of dualism as identified by Perry (Evans et al. 2010). Reflecting on the work of Chickering and the development of the Level-I participants, these students have not reached autonomy towards independence as reflected in the EMCR self-assessment scores for the self-directed learning objectives. These particular students rated themselves lowest in self-directed learning indicating these students are still in initial stages of both Perry's and Chickering's theories for student development.

Results of the Elizondo-Montemayor Criterion Reference assessment (EMCR) indicated that students scored the lowest in the Self-Directed Learning PBL concentration area M= 29.2 (SD=1.64) on the pre-test and M=22.2 (SD=5.17) on the posttest. These scores show the EMCR classified as *Poor* in both the pre-test and posttest for self-directed learning. Whereas the highest score by Level-I was in the PBL concentration area of Collaborative Work, pre-test M=46.2 (SD=8.81) and the posttest M=39.2 (SD=9.76), indicating *Excellent* and *Good*. Table 11 illustrates the five areas of PBL concentration areas within the EMCR for Level-I.

Level-I	N	SD	PreTest Mean	Pre-Test EMCR	SD	Posttest Mean	Posttest EMCR
Application of Knowledge	5	3.71	32.4	Fair	9.25	27	Poor
Clinical Reasoning	5	5.52	45	Excellent	12.68	36.2	Fair
Self-Directed Learning	5	1.64	29.2	Poor	5.17	22.2	Poor
Collaborative Work	5	8.81	46.2	Excellent	9.76	39.2	Good
Attitude/Professionalism	5	2.07	48.6	Excellent	10.45	38.8	Fair

Table 11 Quantitative Results Level-I

Note. Level-I pre/posttest Results EMCR (EMCR=Elizondo-Montemayor Criterion Reference)

Level-II Results

Level-II results of the EMCR indicate students scored the lowest in the Self-Directed Learning PBL concentration area M= 35.4 (SD=17.30) on the pre-test and M=34.2 (SD=6.42) on the posttest. This indicates the EMCR score to be *Fair* in both the pre-test and posttest, whereas Level-I students scored *Poor* in Self-Directed learning. Comparing the difference between Level-I and II (based on the pre/post-test scores), the results indicate student growth in self-directed learning. Level-II scored highest (*Excellent/Excellent*) in Clinical Reasoning (M=Pre 48.8 Post 53.6 SD=Pre 5.36, Post 3.97), Collaborative Work (M=Pre 49 Post 53.6, SD=Pre 8.22, Post 7.67) and Attitude/Professionalism (M=Pre 54 Post 53.4, SD=Pre 4.69 Post 8.88). Table 12 illustrates the five areas of PBL concentration areas within the EMCR for Level-II

Level-II	N	SD	PreTest Mean	Pre-Test EMCR	SD	Posttest Mean	Posttest EMCR
Application of Knowledge	5	3.51	35.4	Fair	3.67	39	Good
Clinical Reasoning	5	5.36	48.8	Excellent	3.97	53.6	Excellent
Self-Directed Learning	5	7.30	35.4	Fair	6.42	34.2	Fair
Collaborative Work	5	8.22	49	Excellent	7.67	53.6	Excellent
Attitude/Professionalism	5	4.69	54	Excellent	8.88	53.4	Excellent

Table 12 Quantitative Results Level-II

Note. Level-II pre/posttest results EMCR=Elizondo-Montemayor Criterion Reference

Level-III Results

The EMCR results for Level-II, I revealed the lowest scores in Self-Directed learning. This result also aligns with Level-I and Level-II. Self-Directed Learning was shown to be the lowest PBL concentration areas for students. Scores for the Level-III pre/post test show an EMCR result of Poor was earned for the pre-test (M=29.2, SD=1.64) and a score of Fair was posted (M=36, SD=4.74) in Self-Directed Learning. In addition, the trend of all three levels scoring high in collaborative work is noted. Level-III scored highest (*Excellent/Excellent*) in two PBL areas Collaborative Work (M=Pre 46.2 Post 55.4 SD=Pre 8.81, Post 4.83), and Attitude/Professionalism (M=Pre 48.6 Post 54.8, SD=Pre 2.07 Post 2.77). Table 13 illustrates the five areas of PBL concentration areas within the EMCR for Level-III.

Level-III	N	SD	PreTest Mean	Pre-Test EMCR	SD	Posttest Mean	Posttest EMCR
Application of Knowledge	5	3.51	35.4	Fair	3.67	39	Good
Clinical Reasoning	5	5.36	48.8	Excellent	3.97	53.6	Excellent
Self-Directed Learning	5	7.30	35.4	Fair	6.42	34.2	Fair
Collaborative Work	5	8.22	49	Excellent	7.67	53.6	Excellent
Attitude/Professionalism	5	4.69	54	Excellent	8.88	53.4	Excellent

Table 13 Quantitative Results Level-III

Note. Level-III pre/posttest results EMCR=Elizondo-Montemayor Criterion Reference

Comparisons of all three academic levels support the individual descriptive statistics for the levels. When comparing the data as a group, the lowest PBL concentration area is Self-Directed learning for each level of students. Additionally students as a whole scored themselves lower in the Application of Knowledge and Attitude/Professionalism. This collection of data is represented in table 14 showing the pre/post test self-assessments for each of the five PBL concentration areas.

EMCR Themes	N	Minimum Score	Maximum Score	Mean ± SD
Application of Knowledge Pre	15	27.00	40.00	33.40 ± 3.68
Application of Knowledge Post	15	15.00	45.00	35.13 ± 8.34
Clinical Reasoning Pre	15	36.00	56.00	46.26 ± 5.39
Clinical Reasoning Post	15	20.00	59.00	47.93 ± 11.47
Self-Directed Pre	15	27.00	46.00	31.26 ± 5.09
Self-Directed Post	15	16.00	40.00	30.80 ± 8.12
Collaboration Pre	15	35.00	59.00	47.13 ± 8.09
Collaboration Post	15	30.00	63.00	49.40 ± 10.34
Attitude Pre	15	46.00	60.00	50.40 ± 3.96
Attitude Post	15	31.00	64.00	49.00 ± 10.58

Table 14 EMCR Descriptive Statistics
Note. Descriptive Statistics - Elizondo-Montemayor Criterion Reference PBL Assessment Note. Overall score means for pre/posttest for the EMCR in Level-I, Level-II, and Level-III

Table 15 illustrates the average scores each academic level achieved on the EMCR self-assessment. The scoring criterion was identified based on the following ranges: Excellent (More than 45), Good (between 45-39), Fair (between 38-32), and Poor (less than 32). Pretest and posttest averages were calculated for each PBL concentration area for each level.

Level	Application of Knowledge	Clinical Reasoning	Self-Directed Learning	Collaborate Work	Attitude Professionalism
Level-I	Poor (M=27)	Good (M=40.6)	Poor (M=25.7)	Good (M=42.7)	Good (M=43.7)
Level-II	Fair (M=37.2)	Excellent (M=51.2)	Fair (M=34.8)	Excellent (M=51.3)	Excellent (M=53.7)
Level-III	Fair (M=35.9)	Excellent (M=49.5)	Fair (M=32.6)	Excellent (M=50.8)	Excellent (M=51.7)
Overall Mean	33.4	47.1	31.0	48.3	49.7

Table 15 EMCR Level Ratings
Note. Average EMCR ratings per level *Scoring ranges: excellent (more than 45), good (between 45-39), fair (between 38-32), and poor (less than 32)

A Kruskal-Wallis statistical analysis was used (4.7) for quantitative measures using the PASW Statistics (formerly SPSS) program. The decision to use the Kruskal-Wallis was determined based on the ability of the statistical analysis to test three or more independent groups. Additionally the Kruskal-Wallis statistical analysis is based on ranked data. The EMCR Scores were imported into the PASW statistical program and ranked lowest to highest. The result of the Kruskal-Walls is demonstrated in table 16. PASW produces the results of the Kruskal-Wallis (*H*) data in the form of a Chi Square (χ^2) test. Data represented in the Chi Square row reveal the association between the pre-posttest results. The degree of freedom (*df)* was two (2) for this study representing the number of entities that are free when running the statistics. A statistical significance of *p=0.05* (Asymp Sig) was used for this study. This study suggests assessing the Level-I, Level-II, and Level-III ATE students at RU.

	Application of Knowledge		Critical Reasoning		Self-Directed Learning		Collaborative Work		Attitude & Professionalism	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Chi-Square	1.538	6.388	1.862	6.477	3.072	7.36	0.548	5.439	5.554	5.173
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig	0.463	0.041	0.394	0.394	0.215	0.021	0.76	0.066	0.062	0.075

Table 16 Kruskal-Wallis Statistical Analysis
Note. p=0.025 *Statistical significance for application of knowledge (p=0.041) and clinical reasoning skills (p=0.394)

Table 16 shows a statistical significance (p=0.025) between the pre and post-assessment scores for the objectives Application of Knowledge (p=0.041) and Clinical Reasoning Skills (*p=0.394)*. This statistical significance specifies all three academic level's participating in the study improved between the pre and post-assessment. Following the Kruskal-Wallis analysis, a posthoc Mann-Whitney U analysis was performed to analyze where the differences lie between the means of the paired PBL objectives and the academic levels. Due to running multiple comparisons, a p value of 0.025 had to be used when comparing the individual PBL objectives and academic levels with one another, therefore reducing the chance for statistical significance to be found. The findings of the Mann-Whitney U analysis showed only one statistically significant difference between Level-I and Level-II in the Pre-Test in the Self-Directed Learning PBL Objective (U=0.50, p=0.012*).*

Quantitative Analysis Summary

The aforementioned data analysis was performed on the Elizondo-Montemayor Criterion Reference (EMCR) pre/post-tests assessment in PBL. The EMCR assessment was designed to be flexible, and adaptable tool for use with PBL courses as a means to collect student learning outcomes (Elizondo-Montemayor, 2004). Assessing the five objectives within the EMCR provided the researcher with a clearer understanding of the learning outcomes regarding students in this study. Table 17 illustrates the rank order of the EMCR for the academic levels studied based on the Kruskal-Wallis analysis. This ranking indicates that AT students performed better in *Attitude & Professionalism* than in *Self-Directed Learning*

EMCR Themes	Chi-Square (χ2)		df	Asymp. Sig	
	Pre	Post	2	Pre	Post
Attitude & Professionalism	5.554	5.173	2	0.062	0.075
Collaborative Work	0.548	5.439	2	0.76	0.066
Clinical Reasoning	1.862	6.477	2	0.394	0.394
Application of Knowledge	1.538	3.288	2	0.463	0.041
Self-Directed Learning	3.072	7.36	2	0.215	0.021

Table 17 EMCR Rank Order.
Collective rank order of Level-I. II. III. Kruskal-Wallis pre/posttest results p=0.025

The areas of *Application of Knowledge, Clinical Reasoning Skills, and Self-Directed Learning* were identified to have the lowest rating for all three academic levels based on the EMCR rating scale (Table 17), however the three aforementioned objectives had statistical significance (p=0.021) showed students within each three levels did improve from the pre-test to the post-test. Research in PBL indicates self-directed

learning to be a key area of development for students (Barrows, 1994, McLoda, 1996, Catlaw, 1999, and Dochy et al. 2003). If self-directed learning is a primary component of PBL, these results may indicate the PBL intervention did not allow for the adequate development of self-directed learning skills. This also indicates students were not developing the Chickering and Perry theories as one would suspect. One would expect Level-I students to have more difficulty with the aforementioned themes than Level-II or III; however, these findings imply upper classman within this study have not fully developed into Perry's positions of relativism and commitment. Furthermore. It may be that students rated themselves higher in the self-directed learning pre-test and did not fully grasp the idea of self-directed learning until the conclusion of the study.

While self-directed learning had a statistical significance in the regression of skills, the area of *Collaboration* resulted in the highest scored areas of the EMCR. The results of the statistical analysis did indicate some improvement within *Collaboration* but lacked the statistical significance to indicate the PBL intervention had a noteworthy benefit. These results correspond with Schmidt, Rotgans, & Yew (2011) research, showing that collaboration promotes collegial development among peers, increases contact with the PBL tutor, and generates positive peer pressure to meet the needs of the group, develops effective communication among peers.

Qualitative Data Results

The qualitative data presented in this section are separated by academic levels in the same manner as the quantitative data previously reported. Using the constant comparative analysis and open process coding for the focus groups and reflection journals, themes emerged, lending themselves to support the five PBL objectives as assessed through the EMCR. These five objectives became the central themes for the qualitative findings. The EMCR PBL objectives were used based on their alignment to the PBL educational objections researched by Barrows (1986).

Qualitative data findings were collected in focus groups, and student reflection journals. Each focus group met face-to-face with the researcher one week after the PBL tutoring intervention. While at the same time, during the week coinciding with the PBL intervention, students completed a reflective journal entry. The following presentation of data represents the qualitative findings for the five themes of the study for each academic level; 1) application of knowledge, 2) clinical reasoning, 3) self-directed learning, 4) collaborative work, and 5) attitudes/professionalism. Throughout the data analysis a synthesis of the student development theories from Chickering and Perry, as discussed in Chapter Two, is presented alongside the data.

Application of Knowledge

Outlined in Chapter II, the application of knowledge is the transfer of new information discovered through research (Becheikh,, N., Ziam, S., Idrissi, O., Castonguay, Y., & Landry, R. 2010). The process by which AT students engage in the application of knowledge is vital to bridging the theory application gap. Deforges and

Lings (1998) identified the application of knowledge as a skill difficult to promote in students.

Each level had significant differences, yet two themes emerged as the top two themes for all three levels. These two were applying research to practical application and learning how problem-solving enhances their ability to apply knowledge. Figure 19 shows the comparison of sub-themes and how the novice learning group (Level-I) had more identified sub-themes indicating their inexperience both in the didactic and clinical setting. In contrast, the sub-themes for Level-III were focused on key themes specifically targeting the application of knowledge.

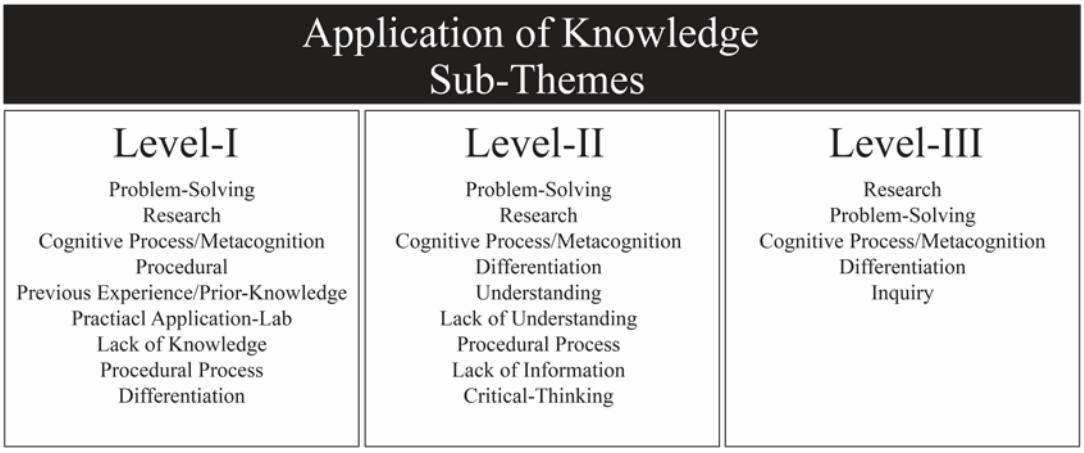


Figure 19 Application of Knowledge Sub-Themes.

Level-I results. The identified sub-themes of the application of knowledge for level-I were problem-solving, research, cognitive process/meta-cognition, procedural, previous experience/prior knowledge, practical application, lack of knowledge and procedural process. Throughout the data analysis, problem-solving was prevalent as these novice learners worked to grasp the intervention and how to solve problems successfully. Data analysis revealed students' lack of knowledge within procedural processes of problem-solving, as well as their reliance on the limited previous experience/prior knowledge they had leading up to the study. The following dialog from focus groups demonstrates how their dependence on their limited experience and knowledge led them towards an inappropriate response to the problem. Furthermore, it revealed their inability to seek out evidence-based practices through research.

> L1-B: I found it interesting how differing opinions played into solving the problem. The way I would treat the wound may not be the same as others. For instance, the different ideas everybody had, such as when L1-C suggested using heal and lace pads for the treatment.
>
> Moderator: Where did you learn about heal and lace pads for the treatment of a turf burn?
>
> L1-C: It is something I have seen done a couple of times. Both here and when I was in high school, it just depends on how much time you have with the athlete. If it's not a deep cut, where you have to spend a great deal of time cleaning up, it's a lot easier just to wrap them up with a heel and lace pad and send them back into play. Rather than take the few minutes they would have to come out of the game to properly clean the wound and apply triple antibiotics.
>
> Moderator: Did you find any research to support the use of heel and lace pads?
>
> L1-C: No, I just have anecdotal evidence that I have seen or heard about from other athletic trainers.

L1-C provided a treatment plan that was not supported through evidenced based practice. The only evidence the student could provide was anecdotal based on previous experiences. The dialog presented in the aforementioned narrative indicates the L1-C level of development consistent with Perry's position of dualism (Evans et al., 2010). L1-C based the argument on anecdotal evidence taught as a "right way" to care for this patient. Here the student is approaching the standard of care as "this is what I was taught" versus critically analyzing the problem and seeking out evidence to support the treatment plan.

Perry's theory indicates novice learners encounter the most difficulty moving from dualism to multiplicity (Evans et al., 2010). In this transition, the student faces conflict from what has been taught by authority figures to developing an opinion based on intellectual growth. This is realized by L1-B when learning the variety of opinions presented by peers during the focus group. It is assumed L1-B expected a "right or wrong" answer from peers when in reality opinions were abundant.

Further comments in this dialog reiterated previous experiences:

> L1-D: I think we just threw out different ideas based on our experiences. We would just shoot out ideas, and I guess elaborate more on it. Someone would say do this because this is what I have done in the past, or to just cover the wound.
>
> MODERATOR: Does this demonstrate best practice?
>
> L1-A: I think by what we've seen, and what we've talked about in class plus adding our common sense to it, we just figured the way we said we treat the injury by what we had seen done before.
>
> MODERATOR: During the process did you actively pursue evidence-based or best practice literature?

L1-C: No we didn't use peer-reviewed sources, it was all based on our experiences and general information.

MODERATOR: Why didn't you think about best practice?

L1-E: Because we have all taken care of wounds before.

This problem was based on a real incident in which a patient suffered a severe second-degree burn to the leg and had to undergo wound care treatments for months. This particular dialog by Level-I students demonstrates their ability to rely on prior knowledge/previous experience for wound care treatment. What they did not do was research the effects of a severe skin avulsion and the appropriate treatment.

These students, in the aforementioned transcription, provided an unsuccessful solution to the problem based on anecdotal evidence, rather than searching for evidence to support proper wound care management for a severe skin avulsion. The anecdotal evidence the students relied on was information learned from an authority figure in athletic training indicating Perry's dualism position (Evans et al., 2010). Hmelo-Silver (2004) studied information processing concepts in PBL and noted construction of a broad knowledge base provides more learning experience versus memorizing facts. Barrows and Kelson (1995) noted student achievement in PBL occurs through the construction of an extensive and flexible knowledge base. The example in Hmelo-Silver's study demonstrates how students call upon prior knowledge for connection to new knowledge. Chickering identifies this development of competence through intellectual and personal growth (Evans et al., 2010). However, students did not use their prior knowledge to call upon or connect new knowledge with this problem. This supports Perry's position of transition from dualism to multiplicity where a broad

knowledge base allows the student to accept varying opinions as noted by LI-C statements. It is assumed by the researcher their reaction was based on their actual inexperience as Level-I students in the areas of inquiry, research, and evidence-based practice. Bransford, Franks, Vye, and Sherwood (1989) identify this phenomenon as inert knowledge. Inert knowledge reflects gaining knowledge, but the inability to apply new knowledge within relative context.

Initially, Level-I students did not understand the necessity of supporting evidence and research to provide an appropriate short-term and long-term treatment plan as seen in the dialog from the focus group one. Students demonstrated difficulty in developing autonomy toward interdependence in problem-solving in problem one (Evans et al., 2010). Chickering's vector of autonomy for interdependence theorizes a student will grow in self-direction and problem-solving abilities while accepting the importance of interdependence (Evans et al., 2010). This transition in Chickering's vector was evident in Level-I students by problem three. L1-A stated in the third focus group:

> In problem one, I just went off of (regarding solving the problem) what I knew – and kind of stubborn about what I knew. In problems two and three, I had to find something (evidence) to back it up (treatment plan). Like what we should do, it was a slow a step by step process…

L1-A's quote, from the third focus group, indicates how the PBL intervention was able to assist in understanding the application of knowledge gained in the classroom and transferring the knowledge into practice within the clinical setting. Initially, during the first problem intervention, Level-I students did not possess the necessary knowledge base and the ability to connect previous knowledge to current research and evidence to

achieve success in problem one (Barrows & Kelson, 1995, Hmelo-Silver, 2004). Transitioning from problem one to problem three students began to recognize the importance of connecting previous knowledge with research and evidence, suggesting Perry's position of multiplicity is evident as the students develop in Chickering's vector of autonomy and interdependence (Evans et al., 2010). Furthermore, students were developing from novice experiences and evolving where they were able to develop a schematic approach to solving the problem (Barrows and Kelson, 1995). In the third focus group dialogue, preceding quote, L1-A relied on finding evidence behind the "why" for treatment plans, whereas before in problem one, L1-D, L1-C, L1-A, and L1-E discussed their reliance on anecdotal experience from professional AT practitioners without acknowledging the need for supportive evidence to answer the why.

L1-A demonstrates how the application of knowledge is the transfer of new information discovered through research as described by Becheikh et al., (2010) in chapter two. Application of knowledge requires the learner to engage in connections made between research and the problem (Becheikh et al., 2010). Once the learner has generated the new knowledge, he or she must adapt the information to current practice trends within their particular setting. Adapting knowledge to practice is essential for transfer of knowledge to be successful and for student development from dualism to multiplicity (Becheikh et al., 2010 and Evans et al., 2010).

Level-II results. Level-II students were more confident (than Level-I students) in their knowledge base and their ability to call upon this knowledge base and experience to work through the intervention problems. Previous experience and prior

knowledge provide students the ability to create building blocks in the problem-solving process and to develop new knowledge (Schmidt, H.G., Rotgans, J., & Yew, E. 2011). The Level-II students had been exposed to PBL the previous year during a pilot program and that PBL experience better prepared them for this tutoring intervention. Level-II students were more developed in Perry's position three of multiplicity subordinate where they were able to recognize and accept the fact authority figures do not always provide concrete answers. Additionally Level-II students demonstrate the traits of position four (multiplicity correlate/relativism subordinate) where everyone has an opinion, argumentativeness prevails, and students focus on changes to their way of thinking (Evans et al., 2010).

While Level-II student had experienced PBL before, LII-B reflected (Figure 20) on how PBL is frustrating, but in this reflective journal response the student also described how working through a problem allows for understanding to take place and the development of new ways of thinking (Evan et al., 2010).

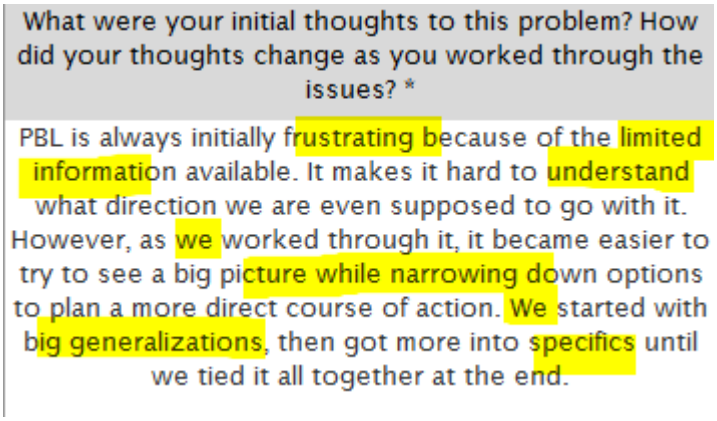


Figure 20 Reflection Journal LII-B[1]
Note. PBL is always initially frustrating because of the limited information available. It makes it hard to understand what direction we are even supposed to go with it. However, as we worked through it, it became easier to try to see a big picture while narrowing options to plan a more direct course of action. We started with big generalizations, then got more into specifics until we tied it all together in the end

The reflection journal entry by LII-B (Figure 20) demonstrates how the process of the PBL intervention, presented in chapter two as idea, process, and action provided a road map for student understanding and application and student development ((McLoda, 1996; Catlaw, 1999; Barrows, 1994; Barrows and Kelson, 1995; Dochy, Segers, Van den Bossche, and Gijbels, 2003; Evans et al., 2010). Synthesizing the information from this reflection indicates the student comprehension of the difficulties within the problem set, but is willing to endure the struggles to gain understanding and application. Chickering identifies this in the developing competence vector. In this vector, student-development focuses on the intellectual growth where knowledge and skills, critical thinking and reasoning are the intended outcomes. LII-B recognizes a need for Chickering's autonomy toward interdependence and the ability to develop independence as a learner

and apply independent learning to the collaborative effort of the group (Evans et al., 2010).

LII-B's reflection journal gives a glimpse into how the process of application of knowledge affected one student. Analyzing a section of the third focus group dialogue also indicates Level-II students were capable of developing connections between research and how these new connections helped to increase their engagement within the clinical setting aligning with Chickering's developing competence vector (Evans et al., 2010).

> L2-D: I find myself looking stuff up a lot on my phone when I discover I don't know something. It has helped me. Like today, I wasn't understanding what they were saying so I quickly looked up during the presentation and was able to follow along better because I was able to understand what they were talking about.

This statement indicates the learner is beginning the transition from Perry's position four, multiplicity correlate/relativism subordinate to position five relativism correlate. In position five student development moves from extrinsic to intrinsic motivation, which is identified in L2-D's initial statement.

> MODERATOR: Has this translated to clinical practice?
>
> L2-B: I think so, during football I trust underclassmen to take a history before I step in and help them when they get to a point where they need it. So I feel like I can say, ok here is what you could have done differently…I am able to take what I have learned from this situation and help them apply it to what they are learning.
>
> L2-E: For me it has been more critical thinking in the clinic, instead of saying "Well I don't know" and automatically asking my preceptor what to do. Relying more on thinking through things and applying what I know to the situation. If I

> don’t know, I know where to find the information and then take the information and use it when I need to.

PBL encourages the incorporation of problem-solving strategies for applying new knowledge as seen in the dialog within the Level-II students (Farnsworth, 1996; Heinrichs, 2002; Maker & Shiver, 2005). Previously discussed in chapter two Barrows and Kelson (1995) and Hmelo-Silver (2004) identified student achievement in PBL through the development of self-directed learning, lifelong learning skills. Transitioning this new appreciation for learning and the application of knowledge, L2-B and L2-E move into Perry’s position five relativism correlate and position six commitment foresaw. This level of student development is a desired outcome for juniors in college. Perry’s position six indicates student-development understands the changing knowledge base, and knowledge is dependent on perception, perspective, and acquisition. Additionally Chickering’s vector of developing mature interpersonal relationships with peers and undergraduates help to create the ability to apply knowledge in the clinical setting (Evans et al., 2010).

In this example, Level-II students’ application of knowledge demonstrates how the PBL intervention has changed their engagement practices, as individuals and as peers within the AT program (Chickering’s developing competence vector and Perry’s position five and six). Students take the new information and work alongside peers to enhance their learning within the clinical setting. In essence these students are creating a standard for application of knowledge through evidence, experience, and collaboration (Barrows, 1986; Barrows and Kelson, 1995; Hmelo-Silver, 2004; and Evans et al., 2010).

Level-III results. Senior AT students comprised Level-III and distinguished themselves as thinking on a higher level than the Level-I and Level-II students. Level-III students displayed more confidence and understanding of how to solve a complex problem. The sub-themes identified through focus groups, and reflection journals support the senior level student's ability to process information differently from the underclassmen. Level-III subthemes are research, problem-solving, cognitive process/meta-cognition, differentiation, and inquiry. Higher order thinking skills are the commonality among these Level-III subthemes. L-III students relied heavily on research and collaboration to work through problems. These senior level thinkers were efficient in identifying the problem, identifying what they knew about the problem, identifying what they did not know about the problem and identifying the evidence to create a treatment/rehabilitation plan.

Level-III student-development follows the continuum of Perry's nine positions. Senior level students have now transitioned into position seven, initial commitment and position eight, orientation in implications of commitment. Depending on their level of intellect and maturity, students may vacillate between position seven and eight until they reach stability and flexibility in their development (position eight). Assuming these students continue to develop along Perry's continuum students should begin the trek to position nine developing commitment during their senior year. Position eight and nine affirms the student's identity, commitment, and the ongoing development of intellectual maturity (Thomas, J., 2008 and Evans et al. 2010). This shift in identity moves from the simplest form of "being professional" to a committed professional engaged in the

enhancement of the chosen field (Perry, 1968, Elwell, 2004, Thomas, 2008 and Evans et al., 2010)

In a focus group dialog Level-III students discussed how PBL affected the application of knowledge.

> L3-B: It (PBL) has showed me to think outside of the box and the benefits this offers. It made me realize you have to think through things and cannot jump to conclusions.
>
> L3-C: I now realize the importance of research and thinking through situations.
>
> L3-B: It has also made me think more of the differential diagnosis process vs. assuming a specific injury and treatment plan.
>
> L3-A: I agree with L3-B, it helped me with creating a differential diagnosis list… Like if there is a prior history and the current signs & symptoms fit and are similar to the history, then I want to make the current one fit the history. Rather than deciphering more of the injury possibilities.
>
> L3-D: It has taught me to think outside of the box – listen to the minute details presented because I am quick to assume, and I sometimes leave off the intricate details. It has personally encouraged me that I can actually go out and find information and solve problems on my own, rather than relying on others.

The focus group dialog between Level-III members demonstrate how learners generate new knowledge through interactions, self-directed learning, and discovery (Becheikh et al., 2010). Chickering identifies this as the developing competence and autonomy toward interdependence vectors (Evans et al. 2010). Once the learner has generated the new knowledge (developing competence), he or she must adapt the information to current practice trends within the particular setting. Adapting knowledge to practice is essential for transfer of knowledge (autonomy toward interdependence as a learner) (Becheikh et al., 2010 and Evans et al., 2010). Dissemination of new knowledge depends on various media to distribute the information to practice. Areas of

dissemination depend upon the credibility, relevance, interpersonal communication, and/or communication delivery methods for the new information (Becheikh et al., 2010). Reception and adoption of knowledge are how the learner sees the benefit of implementation, as well as the application of the knowledge in the form of adoption. Once the learner receives and adopts the new information, use of the new knowledge can begin (Becheikh et al., 2010). The aforementioned research by Becheikh et al. relates to Perry's position seven initial commitment in student development. In position seven knowledge is accepted as diverse and based on the individual learning experiences. This is critical to the success of the AT student engaged in PBL as he/she begins to define their commitment to the profession of AT (Evans et al., 2010).

Clinical Reasoning.

The sub-themes, presented collectively in figure 21, demonstrate the differences between the three levels, research is identified as a key sub-theme for all three levels. This indicates students either were capable of performing research to solve a problem or were unable to solve a problem. Level-one students initially experienced little to no use of research; however, by the conclusion of the study. Students had become more comfortable with performing research. This is to be expected from novice learners as they may not have had the necessary research background prior to enrolling in the university (Perry's position one dualism, Evans et al., 2010). Conversely, Level-II and Level-III students were more than capable of using research within clinical reasoning (Perry's positions of Multiplicity and Relativism, Evans, et al., 2010).

Chickering and Perry both identify reasoning in the process of student development. In the developing competence vector Chickering notes the growth of the intellectual learner through the application of knowledge, skills growth, critical thinking and reasoning as a foundational principle. Throughout the vectors presented by Chickering, the process of reasoning is evident especially within autonomy towards interdependence. Autonomy towards interdependence requires the student to developing reasoning skills to increase self-directed learning and problem-solving (Evans et al., 2010). Perry's positions of multiplicity (two thru four) aligns with Chickering's autonomy towards interdependence and demonstrates how the students understanding of learning and reasoning shifts from one who works to learn, to learning to think more independently (Evans et al., 2010).

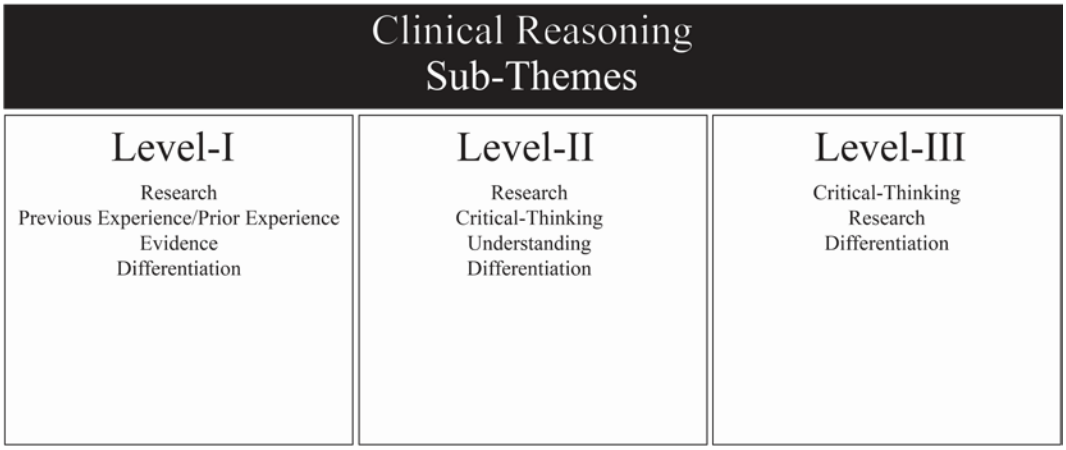


Figure 21 Clinical Reasoning Sub-Themes

Level-I results. The results presented for level-I students revealed the need to increase their clinical reasoning and research expertise. Level-I students had never experienced a PBL intervention before and are classified as novice researchers (Perry's position of dualism). Throughout their initial year in the ATE program, the majority of the clinical field experience is based on observation and learning task oriented skills that require little to no clinical reasoning. This first-year student is immersed in a right or wrong mentality to learning the basic concepts of clinical practice. AT practitioners identify this is as a form of professional assimilation in developing the student (Pitney, Ilsley, & Rintala, 2002). This practice is oftentimes accompanied by the phrase "this is how I learned to do it, and this is how you will learn to do it". In the first year, students receive knowledge from the clinical preceptors and assume this knowledge to be factually true and supported by evidence (Perry's position of dualism). Throughout the first year, the AT student is not challenged with clinical reasoning activities. Therefore the student is entrenched in dualism as a sophomore in college (Evans et al., 2010).

The developing competence vector by Chickering is initiated in both the didactic and clinical portions of the Level-I AT educational process. Here students experience an introduction to the developing competence vector (Evans et al., 2010). Level-I students engage in critical thinking and reasoning exercises in the classroom. The PBL intervention is designed to provide students the opportunity to develop reasoning in a controlled environment. In the development of reasoning, student are instructed in research methods to incorporate into their clinical decision-making process.

One key factor noted in the Level-I focus groups is the need to develop more extensive research skills. Furthermore, the level-I students realized how the important evidence-based practice is for clinical reasoning. The evidence-based practice has become a standard for the allied health community, and the treatment/rehabilitation domain is a critical area that demands practitioners use best-practice standards. This requires the AT to have well developed clinical reasoning skills to make the necessary adjustments to the treatment/rehabilitation plans. The sub-themes identified for clinical reasoning for Level-I include research, previous experience, evidence, prior knowledge, and differentiation.

The Level-I students did not use any research supported evidence or clinical reasoning within the first problem set of the study, relying completely on the dualism position identified by Perry (Evans et al., 2010). Students had difficulty challenging the "way" it had been demonstrated or taught them as an AT authority figure had been the one to "teach" them. However, by the second focus group, Level-I students identified an improvement in their knowledge and use of research. The following dialog from the second Level-II focus group discussion demonstrates how students adapted from problem one to problem two.

> L1-E: This week it was more challenging, we took the initiative to look things up, we had to research and find evidence. It was a good thing as we had to think and not rely on anecdotal evidence.

L1-E identifies the need for Chickering's autonomy towards interdependence vector. Additionally the student realizes the pre-legitimate multiplicity position where he/she is learning a differing perspective.

> L1-A: This week we had supporting the evidence we were able to use in our clinical treatment/rehab plan vs. our approach from last week. The new information within the research was critical.
>
> L1-C: Much of what we have had to do in the clinic (up to this point) has not involved decision-making skills or developing a treatment plan. We have always executed the treatment plan that was designed by someone else. Now having been through this I feel like I am capable of starting the process and applying what I know in the situation my preceptor may place me in.

L1-C statement is a clear recognition of Perry's dualism position and his/her desire to move forward in development to multiplicity and beyond.

Level-I students demonstrate the dualistic and novice practice standard where they are given task oriented assignments. Each student in this focus group gained a better understanding of the use of research in the development of clinical reasoning skills through the PBL intervention. When asked, why they felt the PBL intervention was assisting in this process, one particular focus group response provided the best summation for Level-I:

> L1-C: I think it (PBL) gives us a chance to work through a situation from the beginning and put together everything we learned in a controlled environment allowing us to develop confidence and the necessary knowledge we need to have for our clinical experiences.

L1-C identifies with Chickering's development of competency and autonomy towards interdependence in this statement. Students are capable of gaining an identity as well through a change in acknowledging differences among peers and self-esteem as seen in the establishing identity vector. Students begin to realize the position of multiplicity allows learning to take on differing perspectives that will eventually lead to relativism and commitment of the learner.

Research performed by Walker (2012) emphasizes the need for the development of critical thinking and clinical reasoning. The focus group examples demonstrate how students are developing depth and complexity when presented with a problem in a controlled environment. These students were able to learn from the previous week one experience and develop a plan that would give them the best opportunity to be successful as learners. The above focus group dialog supports Walker's emphasis on the development of clinical reasoning skills. Students are processing the information and determining, based on research and evidence, the best possible solution to the problem set. The evidence is seen in the quote provided by L1-C

> "Much of what we have had to do in the clinic (up to this point) has not involved decision-making skills or developing a treatment plan. We have always executed the treatment plan that was designed by someone else. Now having been through this I feel like I am capable of starting the process and applying what I know in the situation my preceptor may place me in."

Level-II results. Level II students understood the need for research, critical thinking and understanding in order to develop sound clinical reasoning, aligning with Perry's position of multiplicity. Throughout the study, level-II students were capable of creating a differential diagnosis list and treatment/rehabilitation plan based on the information obtained through the PBL intervention, supporting Chickering's developing competence, autonomy towards interdependence and establishing identity vectors. Sub-themes for Level-II are research, critical thinking, understanding, and differentiation.

Level-II students identified an increase in confidence, assessment, personal awareness, and the ability to transfer new knowledge into practice. Chickering classifies these attributes in the developing competence, maturity, and integrity vectors as well as

the establishing identity vector. Level-II students reveal many of the traits developed in each vector including; critical thinking, reasoning, self-direction, problem-solving, interdependence, self-esteem, and a balanced interest in others and self (Evans et al., 2010).

The PBL interventions allowed students to practice clinical decision-making skills within a controlled environment, allowing them to feel "safe" in the event they make a mistake. Barrows (1994) indicates a controlled and safe environment is capable of increasing the student's engagement, as well as his or her critical thinking skills because the student does not face the fear of doing something wrong on a real patient. Focus group dialog emphasized how students were capable of developing confidence in creating clinical reasoning skills.

> L2-E: "This intervention has shown me we do have the ability to think critically on our own. I think it has made us more comfortable with doing it, and it has made it easier to transfer it to practice. I have more confidence to assess something or come up with an answer to something. It also encourages me not to give up right away."

L2-E statement supports Chickering's establishing identity vector through self-esteem. Perry's position five, relative correlate, demonstrates L2-E's intrinsic motivation to engage in learning and practice.

> L2-D: I think it has raised my awareness to know I need do more outside of the clinic when developing researching what to do with the development of treatment and rehab.

L2-D's statement supports Perry's continuum of transforming from dualism to multiplicity to relativism. Furthermore, L2-D demonstrates developing competence and autonomy towards interdependence.

The above dialog represents how Level-II students began to realize they were capable of critical thinking. Dochy et. al. (2003), and Walker (2012), note that the practice of critical thinking is essential for athletic training students and is supported by the research of Barrows (1986), Barrow and Kelson (1995), and Hmelo-Silver (2004) and Evans et al. (2010). AT students realized they were capable of solving complicated problems by developing an understanding of the problem followed by the use of research to create a differential list to generate a treatment/rehabilitation plan.

When students understand the need for a particular skill set (i.e. clinical reasoning skills), or if information finally "clicks" for students, a moment of learning takes place that many call the "Ah-Ha" moment. L2-E had an "Ah-Ha" moment during the third week and reflected on this learning occupation through the reflection journal (Figure 22).

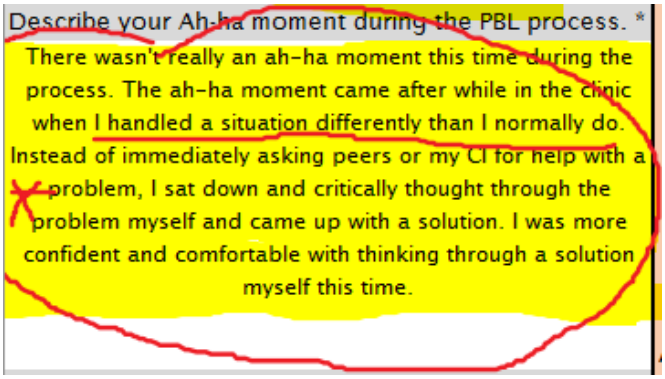


Figure 22 Reflection Journal LII-E
Note. There wasn't really an ah-ha moment this time during the process. The ah-ha moment came after a while in the clinic when I handled a situation differently than I normally do. Instead of immediately asking peers or my CI for help with a problem, I sat down and critically thought through the problem myself and came up with a solution. I was more confident and comfortable with thinking through a solution myself this time.

L2-E notes a couple of key themes here in the reflection journal. First she notes the "Ah-Ha" moment did not occur during the PBL intervention but rather during the clinical experience. This indicates application of knowledge and Perry's position two, three and four. In position two L2-E notes, learning has taken place using a different perspective this is the multiplicity pre-legitimate position. The student has realized her learning was impacted from a differing perspective vs. the dualistic approach of right or wrong. L2-E then transitions into position three multiplicity subordinate by replacing the dualistic approach she was accustomed to previously. Lastly, L2-E enters position four through changing the way she thinks, this is supported by the statement "I was more confident and comfortable with thinking through a solution myself this time."

Second she states "I handled the situation differently than I normally do." Typically, when faced with a problem, students would immediately go to the clinical preceptor or peers for help. In this incident, the student relied on a new found confidence to critically think through the problem, showing clinical reasoning. This was a significant step forward in the development of L2-E's clinical reasoning skill set as well as a student. Here L2-E is seen on the cusp of transitioning to Perry's position five relativism correlate where she is more intrinsically motivated to learn and apply clinical reasoning skills. This is also supported by Chickering's autonomy toward interdependence, developing competence, and establishing identity vectors (Evans et al., 2010).

Level-III results. The Level-III students displayed continued higher order thinking skills as related to focus groups from Level-II and Level-I. The approach these

students took to solve the problem followed well developed clinical reasoning rationales. Level-III students were capable of clearly defining the problem and were proficient in developing treatment/rehabilitation management plans for the problems presented. The sub-themes of critical-thinking, research, and differentiation were identified as sub-themes for level-III. When comparing the sub-themes in clinical reasoning with the Level-I students evidence supports growth will occur over the course of a cohorts progression in a program to that of the sub-themes identified for Level-III. The sub-themes presented for Level-I students demonstrated their knowledge base had not evolved to appreciate the need for critical thinking, research, and differentiation, whereas the Level-III learners demonstrate learning over time and exhibit a greater depth and understanding of clinical reasoning as a cohort.

Level-III students were completing their final semester in the ATE program. These students were asked the question: "If a PBL tutoring intervention had been made available to you as Level-I students, do you think it would have helped or slowed your development?"

> L3-A: I can without a doubt say that if PBL had been a part of my experience in my first year it would have been beneficial. It (PBL) developed a mindset of thinking outside the box and walking through the process with logical steps of reasoning. I feel this would develop trust in myself.
>
> L3-C: Athletic Training is about solving problems. When I was in high school, I didn't have to solve problems… we did worksheets, tests, etc… not problem-solving. We are used to that and used to being able to find the correct answer. Whereas in AT you solve problems… w/PBL you solve problems using the text scenario, but you formulate a way to solve the problems in your mind.

The above statement by L3-C identifies the developmental process theorized in Perry's positional continuum. L3-C recognizes dualism as the base of knowledge prior to

entering college and translates the PBL intervention into the process of developing the learner along the continuum. The previous statement by L3-A demonstrates the need to implement teaching and learning strategies early in the curriculum to assist student development. Early implementation of PBL into the AT curriculum can help guide students through Perry's theory (Evans et al., 2010). L3-C relates the profession of athletic training to solving problems. Athletic trainers must use problem-solving skills to synthesize the information provided by patient histories and physical examination to assess illnesses/injuries. L3-C demonstrates how learning over time takes place as a student progresses from high school to a college senior (Houglum & Weidner, 2001 and Hmelo & Silver, 2004).

Students from all three focus groups were able to make connections between PBL and the development of clinical reasoning skills. Further qualitative data from the focus groups demonstrate this connection.

> L2-C (Level-II): The PBL session help teach us how to go through a problem, by not using a cookie cutter approach. Thinking about the bigger problem, step by step with reasons for why we are doing what we are doing. It has helped to fill in any gaps where there are unknowns.

L2-C demonstrates how the PBL process requires a deeper engagement with the information and, in the case of AT, the patient. This response paints a picture of the "why" for many students. Allowing students to think of the bigger problem, empowering them to search deeper within the problem assists in the understanding of the "why". Answering the "why" can be seen in Perry's positions two, three and four. Students merge into multiplicity from dualism and experience learning from a different perspective, realizing relativism, and focus on the changing the way he/she thinks in

regards to clinical reasoning. Students begin to develop the autonomy and interdependence as theorized by Chickering through self-directed learning, problem-solving, and reassurance.

> L1-D (Level-I): Made me think deeper because usually you will find that this exercise works for some and then you have those that the exercise doesn't work as well. That makes me think, what are we doing wrong, what do we need to adjust or change.

L1-D is a novice learner and recognizes the need to reflect deeper when approaching the problem. This student's reflection indicates not everyone is capable of working successfully in the PBL intervention, but this leads to a deeper reflection of "how do we need to adjust or change" to help the learners grow in clinical reasoning. L1-D experiences the initial process of multiplicity in identifying different perspectives for learning and clinical reasoning development.

> L1-C (Level-I): I think the PBL sessions are teaching us how to think about a problem and tie everything together. What we get in class you memorize facts/figures/details… remember for the test – you might remember something for the clinic and you might not. Where PBL is showing us how to take everything, we know and working through a problem rather than randomly guessing and saying we think we know something.

L1-C acknowledges the existence of dualism in the learning process where the AT educator is the authoritative presence. Moreover, L1-C recognizes the developing competence vector of understanding and using PBL intervention. The student in this instance is now in multiplicity pre-legitimate position realizing authority is not always have the right answers.

The implications made by students regarding clinical reasoning indicate the importance of developing an instructional strategy that will foster and develop each

student's ability to increase the integration of theory into clinical practice (Norman & Schmidt, 1992). The engagement of clinical reasoning skills, as noted in the above dialogue, aligns with the work of Norman and Schmidt, in which student's acquisition of knowledge and reasoning is enhanced through real-world problems when engaged in an activity-based instructional strategy versus the traditional lecture form of instruction (Norman & Schmidt, 1992).

Self-Directed Learning

Student achievement in PBL relies on developing self-directed learning skills (Barrows, 1986; Barrows and Kelson, 1995; Amador, Miles, and Peters 2006). Analyzing the self-directed learning objective revealed all student subjects (Level-I thru Level-III) indicated a lack of effort in developing self-directed learning skills. Once the problem-set and tutoring intervention was completed, students did not pursue or reflect on the problem in all nine problems presented. This information is discouraging, as self-directed learning is a necessity for the development of the application of knowledge, collaborative learning, and clinical reasoning (Amador, Miles, & Peters, 2006). The Self-Directed Learning theme had the least number of sub-themes associated with qualitative data analysis out of the five PBL objectives measured by the intervention and the EMCR. Additionally students learning styles were sub-themed within the self-directed learning theme indicated in Figure 23.

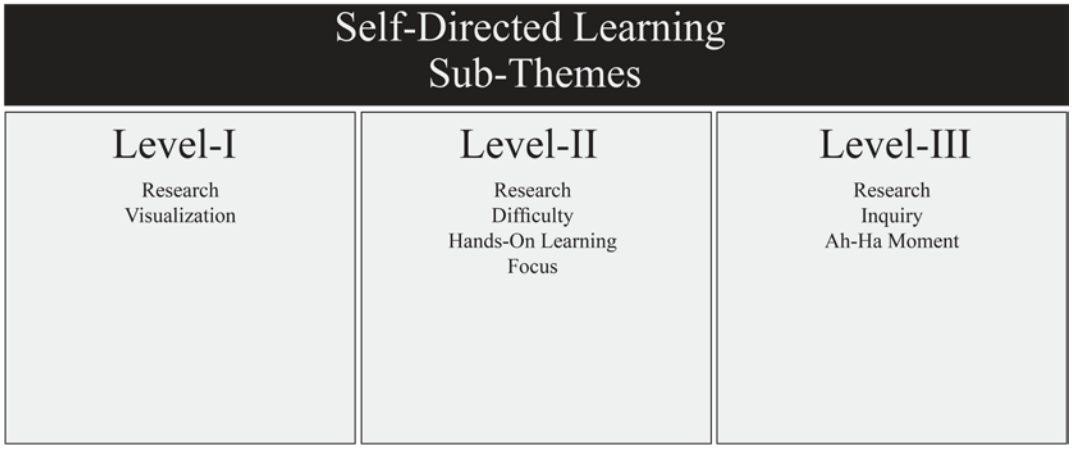


Figure 23 Self-Directed Learning Sub-Themes.

Level-I results. Level-I students had the fewest identified sub-themes within the self-directed learning theme out of the research subjects. The sub-themes identified were *Research* and *Visualization.* Level-I students noted the initial challenge and difficulty with the engagement of research; however, by the end of the study, some progress had been made with their ability to use research. Level-I students demonstrated a lack of understanding of self-directed learning as evidenced in their responses to the question: "how has your personal engagement for learning changed through the study?"

> L1-C: "I don't think I have changed. Because PBL is so new, I haven't really noticed much change in how I learn in the classroom and the clinic."

L1-C recognizes the challenge presented within the PBL model. Again, the researcher recognizes the dualism position noted in Perry's work. This is to be expected from the Level-I students as this was their first exposure to PBL, however it was surprising to see students (all subjects) disengage in the process once the intervention was completed for the week.

> L1-D: "I don't think it has changed how I learn in the clinic or the classroom yet, because we have not done it enough, and I just I don't engage myself as much as I should when I am in the classroom."

L1-D's honesty demonstrates the level of disengagement within the PBL sessions as well as how learning is achieved outside of the intervention. Again, Perry's position of dualism is seen in this response. The assumption is L1-D still relies on the authority of the clinical preceptors and faculty to "teach" the material and to take all material as face value without learning differing perspectives are acceptable.

> L1-A: "I don't think it has made any changes. I do notice that I ask "why this, why that" more often. My brain is cranking a little bit more in the clinic, but in the classroom, I just don't like the way things are being taught. So I don't really engage myself, I try, I can't figure it out, so I just jot down notes and hope it sticks."

L1-A's response shows a lack of desire to develop competence as described by Chickering's vectors. This too also demonstrates a novice learner caught in dualism with little intrinsic motivation to engage in the learning process.

The evidence presented in the Level-I focus groups was superficial and lacked a depth of understanding for self-directed learning. Level-I students were entrenched in the position of dualism regarding this particular objective of the EMCR. These three students believed PBL did not change their engagement practices, nor did they attempt to question the authority of the preceptors and educators. The bold statements of "*I just don't engage myself…"* and *"I just don't engagement myself as much as I should…"* by students corroborates Perry's theory of student development where students will experience difficulties transitioning from dualism into multiplicity. This assumption is due to the lack of prior knowledge and inexperience within the athletic training

education curriculum as well as with PBL. The analysis of Level-I students indicates they did not place personal learning as a priority as defined by (Schmidt, H.G., Rotgans, J., & Yew, E. 2011).

Level-II results. Four sub-themes were categorized under self-directed learning for Level-II. These were *research, difficulty, hands-on learning* and *focus*. There was a slight increase for Level-II self-directed learning. As previously noted in the Clinical Reasoning theme, research was categorized as the top recurring sub-theme. This specifies how research plays a vital role in the development of the learner participating in PBL. All participants identified themselves as hands-on learners.

Specific responses to self-directed learning were limited due to group dynamics. Periodically Level-II students did not provide substantial discussion. Chickering identifies collaboration with others as a component to the developing competence vector. Level-II had collaboration difficulties not only among peers but also in focus group discussion. A combination of factors could have contributed to this lack of engagement, these include time of day, commitment level, desire to participate, and overall disposition. Data analysis did provide a focus group dialog offering insight into self-directed engagement influence for two Level-II students.

> L2-A: How to think outside of the box. Building upon things we have learned before and incorporate other classes that support AT core classes. Allowing me to think through it.

L2-A demonstrates the ability to recognize prior knowledge as a factor to increase self-directed learning. Developing competency in knowledge and skills and

critical thinking are supported as well. The statement "allowing me to think through it" reveals the student is moving in the realm of multiplicity through positions two thru four.

> L2-D: I think it has raised my awareness to know I need do more outside of the clinic when developing researching what to do with the development of treatment and rehab. PBL convinced me to take my education more into my own hands instead of relying completely on my teachers. I can take from my experiences and combine that with what I learn. I have started learning a whole more outside of school, more than I have done before.

L2-D is also on the path to multiplicity and seeking relativism correlate (position five). L2-D recognizes the need for intrinsic motivation to learn which correlates with Chickering's autonomy towards interdependence vector. This student is developing along the Perry positional continuum as a junior and appears to understand the importance of self-directed learning which over time will lead to relativism and commitment (Evans et al. 2010).

The dialog presented by L2-A and L2-D demonstrates how the PBL intervention led to an understanding that learning does not occur only within the classroom. As L2-D stated, *"PBL convinced me to take my education more into my own hands instead of relying completely on my teachers."* This statement is critical for this student, who subsequently did change his approach to self-directed learning. In the developing AT student, learning takes place both in and out of the classroom/clinic (Abraham, Upadhya, and Ramnarayn, 2005 and Evans et al. 2010).

Level-III. Level-III students also had a slight increase in their engagement practices with the content through the PBL intervention. The sub-theme of research was again the most frequently encountered. Students within Level-III stated their interest in

research had been stimulated and their ability to respond to self-directed learning increased. The sub-themes were unique to this group research, individual, inquiry, and Ah-Ha moments. Self-directed learning promotes connecting the content with the application as well as aiding the student in formulating learning goals and strategies (Abraham, Upadhya, and Ramnarayan, 2005, Amador, Miles, & Peters, 2006).

Through connecting the content with the application, as suggested by Abraham, Upadhya, and Ramnarayan, (2005) and Amador, Miles, & Peters, (2006), students experienced multiple "Ah-Ha" moments. Additionally Level-III students worked more as individual researchers through inquiry and discovery before entering into a group collaboration. Level-III students recorded their Ah-Ha moments in the reflective journal and are presented in the preceding section (Figures 24, 25, & 26).

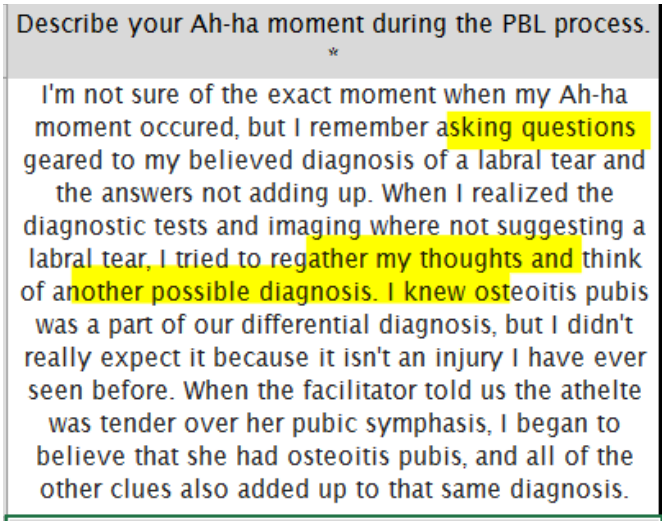


Figure 24 Reflection Journal LIII-A
Note. I'm not sure of the exact moment when my Ah-ha moment occurred, but I remember asking questions geared to my believed diagnosis of a labral tear and the answers not adding up. When I realized the diagnostic tests and imaging were not suggesting a labral tear, I tried to regather my thoughts and think of another possible diagnosis. I knew osteitis pubis was a part of our differential diagnosis, but I didn't really expect it because it isn't an injury I have ever seen before. When the facilitator told us the athlete was tender over her pubic symphysis, I began to believe that she had osteitis pubis, and all of the other clues also added up to that same diagnosis.

L3-A notes the process of internal questioning and self-directed though to engage the problem. Working through the problem as an individual allowed the student to process information and create a differntial diagnisis list leading to further questioning. Through this process, the student was able to connect the information back to the problem and offer a plausible solution.

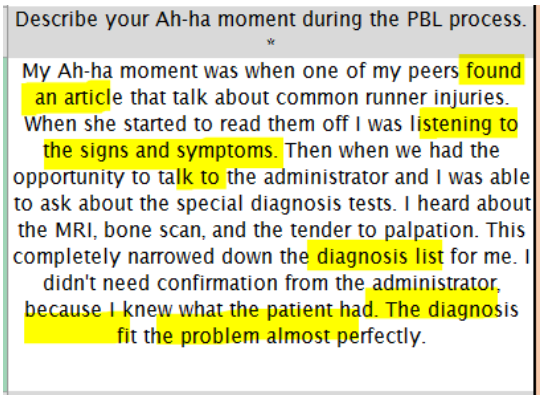


Figure 25 Reflection Journal LIII-D[1]
Note. My Ah-ha moment was when one of my peers found an article that talk about common runner injuries. When she started to read them off, I was listening to the signs and symptoms. Then when we had the opportunity to talk to the administrator, and I was able to ask about the special diagnosis tests. I heard about the MRI, bone scan, and the tender to palpation. This completely narrowed down the diagnosis list for me. I didn't need confirmation from the administrator because I knew what the patient had. The diagnosis fit the problem almost perfectly.

L3-D reflects how self-directed learning from a peer ignited the Ah-Ha moment. In this reflection, another student presented an article specifically addressing the possible diagnoses for the injury. Using critical thought and independent analysis this student was able to validate the signs and symptoms to make a draw a positive conclusion to the problem.

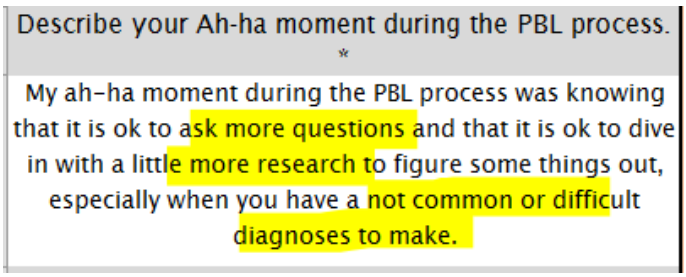


Figure 26 Reflection Journal LIII-E[1]
Note. My ah-ha moment during the PBL process was knowing that it is ok to ask more questions and that it is ok to dive in with a little more research to figure some things out, especially when you have a not common or difficult diagnoses to make.

L3-E related back to seeking research to solve the problem. This is truly a self-directed learning activity. This student also was capable of gaining confidence in questioning through the problem set.

These aforementioned analysis of Level-II and Level-III students demonstrate some engagement influence provided by the PBL intervention. While Level-II and Level-III responses were limited, they supported a change in the engagement practice. In Thomas' (1997) Newble & Clark (1986) reported students who participated in PBL activities were more likely to find engagement and meaning from their study versus the traditional classroom. Additionally Thomas (1997) reported an increase in class activity attendance and library book acquisition in medical students participating in a PBL courses.

One key concern presented by the engagement practice was student's lack of self-directed learning during the intersession between the PBL intervention and the PBL solution, during a one-week period. When questioned if the PBL groups actively engaged one another during the week between PBL sessions the answer was a collaborative no. Students stated they tried to complete the entire PBL exercise during the intervention period. Therefore, there was no outside learning that took place between PBL intervention and solution/focus groups. This lack of self-directed learning is supported by the EMCR. Students scored the lowest in self-directed learning on the pre/post-test assessment.

Chickering's vectors play a vital role in the development of the self-directed learner. This is evident when comparing Level-I and Level-III students. Level-I students had little development of self-directed learning as identified in the vectors by Chickering. Whereas, Level-III students demonstrated characteristics of these vectors. Level-III students were at the culmination of developing competence whereas Level-I

students had only just begun. Level-III students participated in autonomy and interdependence while developing meaningful commitments to learning and balance the interests of their peers and themselves.

Collaborative Work

Collaborative work within PBL is designed to foster teamwork collegiality as well as establish a common platform to work and learn. Furthermore, collaborative work in the PBL group should encourage conflict resolution between members and interpersonal communication skills, and foster an environment that promotes the free exchange of ideas (Barrows and Kelson, 1995; Hmelo-Silver, 2004). Schmidt, Rotgans, and Yew (2011) support the efforts of collaborative work within the small group setting by providing an avenue for interpersonal development, an intimate learning environment, and to foster peer motivation. Figure 27 illustrates the differences between each level and the sub-themes that were identified.

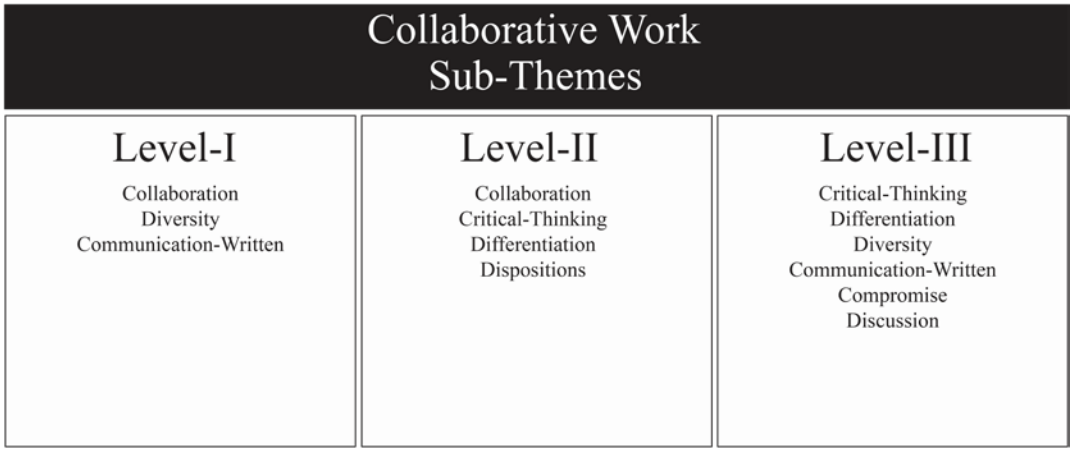


Figure 27 Collaborative Work Sub-Themes

Generally speaking, each group worked well together and did not have any significant difficulties that prevented completing the PBL intervention problems. The preceding comments are a collection of responses from the focus groups demonstrating the student responses regarding collaborative work.

> L1-E: I think solving a problem as a group helps you get to know each other better. How you would figure something out and then you could take your ideas and others ideas incorporate the two to get it done faster or better. More efficiently.
>
> L2-B: I think I learned to work better at collaboration. Ever since elementary I have hated group work because I always felt like I was doing all the work. Whereas with this group I feel like I can trust the group and step back and let them do their part and trust they are going to accomplish their task. So now I don't think I have to do it all
>
> L3-D: You have to work with different people, and lots of time multiple people may be working with the same patient. So it is important that we are all working together for the patient.
>
> L3-A: I think for this problem (referring to problem scenario one), it was a good thing to be in a group to discuss how we would handle the situation before we are placed in that situation as professionals. It gives us a pattern to know what we might do and how we might handle a situation.
>
> L3-E: Working in a group this week went much better. Not that it was bad last week. Having more experience with PBL helped us. We all collaborated really well together.

The aforementioned student statements indicate the effects collaborative work within PBL has within the learning community. Chickering identifies collaborative work as an element in developing competency vector and in the developing mature interpersonal relationships. The process of student development and collaborative work enables the student gain an appreciation for the ideas and opinions of his/her peers. Students may develop quicker in these situations dependent upon prior experiences and

knowledge. Perry notes the appreciation of opinions as a factor for developing multiplicity. This is the acceptance of ideas from others are as important as authority figures (Barrows, 1986; Barrows & Kelson, 1995; Barron, 2002 as cited in Hmelo-Silver, 2004; Schmidt, Evens et al., 2010; Rotgans, & Yew, 2011).

L1-E was capable of identifying the collegiality and teamwork goals of collaborative work. Trust, indicated by L-2B, revealed a prior bad experience with small groups transformed into a positive experience. L3-E was comfortable within the group and trusted everyone. Level-III students encountered a conflict resolution scenario in the first PBL intervention, L3-A believe teamwork was the catalyst for discussing how each person would resolve the conflict between an experienced athletic trainer and a novice. Level-I students agreed their level of face-to-face collaboration increased as the study progressed. They admired the diversity of ideas and solutions to the interventions members of the small group developed. Level-I students did not initiate any form of written communication during the interventions. They relied solely on collaboration during the tutoring sessions.

Level-II results. Level-II student's reported the difficulties of working together. Key factors, such as time of day, the amount of time needed, differing opinions, as well as nutritional needs, accounted for their group dynamics. The introduction of the individual student's disposition to the problem set increased the tension within the group (Figure 28). The sub-themes for Level-II paint a slightly negative picture of the collaborative work theme.

The overall disposition of the Level-II students did not foster a collaborative work environment. In terms of student development theory, Level-II students give the impression they are lagging behind in collaborative work scenarios as compared to Level-I (Evans et al., 2010). Students acknowledged critical thinking as a key factor for collaborative work; however the disposition of students did not foster differentiation of ideas and create a healthy collaborative experience. Level-II student's reported the difficulties working together can produce (transitioning from dualism to multiplicity as identified by Perry). Key factors such as time of day, the amount of time needed, differing opinions, as well as nutritional needs accounted for the poor performance in collaboration.

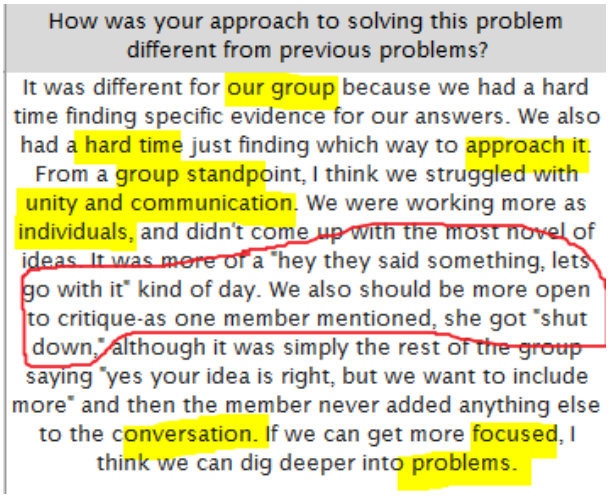


Figure 28 Reflective Journal from LII-B[2]
Note. It was different for our group because we had a hard time finding specific evidence for our answers. We also had a hard time just finding which way to approach it. From a group standpoint, I think we struggled with unity and communication. We were working more as individuals and didn't come up with the most novel of ideas. It was more of a "hey they said something, let's go with it" kind of day. We also should be more open to critique as one member mentioned, she got "shut down," although it was simply the rest of the group saying "yes your idea is right, but we want to include more", and then the member never added anything else to the conversation. If we can get more focused, I think we can dig deeper into problems.

The reflection journal entry by L2-B demonstrates healthy thinking in regards to group dynamics. This student is capable of evaluating the group with a critical eye for collaboration (Chickering's developing competence vector, Perry's position of multiplicity). Unity and communication were noted as two critical problems with Level-II. L2-B believed more people were working as individuals versus working in collaboration with one another. Additionally L2-B recognized how the group work can alienate individuals who may have a differing thought process (Chickering's developing mature interpersonal relationships vector). When alienation occurred, the group lost a member because the student "shut down" and did not re-engage. Lastly, the focus could have improved the overall collaborative efforts of Level-II. This group, in particular, struggled with focus from the problem to problem (Chickering's developing purpose vector).

During week three (3), Level-II faced a significant collaboration issue when working through problem two (2). Students noted fatigue and time of day as the catalyst for poor collaboration. In focus group session two (2), the Level-II group was questioned about group dynamics during problem two (2) PBL intervention, they candidly responded.

MODERATOR: Tell me about your group dynamics.

L2-B: Hindered us because we were all pretty grumpy. We wanted to get in find the answer and get out.

L2-A: I just shut down and sat there; because I was grumpy, in a mood, and I thought it was something and let them do their thing.

MODERATOR: Do you think the time of day has a significant influence in how well the group works together.

L2-A: I would say so because we all have busy schools. We were all in moods

L2-C: It's Dinner, let's do this, get out of here, take a shower, do homework, so we can go to bed early.

MODERATOR: There is another group meeting at the same time, and they didn't have the same problems? Why don't you think they had this problem?

L2-B: other external factors that we brought in. I think all of that together makes a difference also I have been through PBL before, and it's frustrating and when you sign up to do something that is already frustrating it adds to it. And it's hard to go into it with a happy face.

This unintended consequence of collaborative work provided the opportunity to take the real-world problem of working together to illustrate a point within the focus group. The Researcher asked an additional question to the Level-II students when he noted these responses; "If you were to finish your degree right now (with everything you know) no more schooling, and you had to go into a situation where you had to work with a group of people after a long day, how does that prepare you for a real life situation?" Student's responses were mixed and interesting. L2-D, "I would probably act the same…" L2-A reflected on the fact the problem was not real, "in a real world problem we would act differently. This is a study, and we would get this (PBL problem) so we can go home." These insights demonstrate the need for continued collaborative work

development.

The aforementioned statements by L2-D and L2-A indicate difficulties in developing purpose vector and developing mature interpersonal relationships. Level-II students genuinely had difficulty developing as collaborative workers. (Evans et al., 2010). The evidence provided by the Level-II unintended consequence demonstrated how individual attitudes and dispositions can affect collegial development among peers. Collaborative work is essential to narrow the theory application gap (McDaniel and Colariulli, 1997). Schmidt, Rotgans, & Yew (2011) identify the small-group collaboration as an effective avenue to generate positive peer pressure and to develop communication. As demonstrated by the examples provided in the focus groups from Level-II, collaboration as defined by Schmidt, Rotgans, & Yew (2011) was not achieved.

Level-III results. Level-III students exhibit Perry's positions of relativism and commitment. Level-III students discovered the possibilities that collaborative work offered the allied health professional (commitment). Students stated the PBL intervention required them to think critically through each step and create a differential list to help guide them to a solution for the problems (relativism). The sub-theme of diversity also empowered students to learn from differing perspectives (relativism). The reception of the Level-III students to collegial work was not surprising since these students had developed a good rapport over the course of their academic careers (commitment) (Evans et al. 2010).

Students noted the need for increased communication via email or text messages to avoid miscommunication within the group. This is a by-product of collaboration as defined by Schmidt, Rotgans, & Yew (2011). Additionally they noted compromise as a key to their success working together.

> L3-C: helped that we collaborated and bounce ideas off each other and were willing to listen to what the group had to say. The varying opinions really helped me to develop my own thoughts.
>
> L3-A: our group worked well because of compromise.
>
> L3-B: Working in a group this week went much better. Not that it was bad last week. Having more experience with PBL helped us. We all collaborated really well together. In programs like this and the clinic. In problem one – we immediately came together as a group and for me I didn't formulate my own thoughts I just piggy-backed what others said. During problem two and three, we did independent research for the first 10-15 min we received the problem, and that forced me to formulate my own ideas so that I would have something to share with the group. I think during problem one there were strong opinions between members, but we worked better as a group during problems two and three.

The data snapshots from Level-III provided collegial development of peers. Students were able to increase their communication between peers, as well as meet the needs of the group, through independent study/research prior to small group meetings. This again supports the small group collaboration model provided by Schmidt, Rotgans, & Yew, (2011), which promotes peer-assisted learning/development, positive peer interactions, and communication.

Attitude & Professionalism

Research by Pitney, Ilsley, & Rintala (2002), discussed in chapter two, notes the notes the process of professional socialization as a way of learning the "knowledge, skills, values, roles, and attitudes associated with professional responsibilities" through a two-part development process known as anticipatory socialization and organizational socialization (Pitney, Ilsley, & Rintala, 2002, p. 286) There is a need for attitude and professional development within PBL to foster clear communication leading to greater understanding and more collegiality (Thomas, 1997). Thomas also noted that the development of PBL scenarios should stretch the attitudes of students during the engagement practice providing opportunities for students to engage in positive and negative situations (Thomas, 1997). Professionalism is identified as a foundational behavior in the Athletic Training Edition Competencies 5th Edition (NATA, 2011). The AT student should be a strong supporter of the profession, have honesty and integrity, show compassion and empathy to patients and peers, and be able to have effective interpersonal communication (NATA, 2011). Formal assimilation is comparable Perry's scheme of dualism where students receive knowledge from an authority figure, and it is understood there are right ways and a wrong ways of performing. Mazerolle, Bowman, and Dodge (2014) noted formal assimilation occurs through programmatic design by way of an *Introductory Course, Observation Hours, Orientation Sessions, Student Handbooks, AT Student Club Activity, and Organized Peer Mentoring.* The clinical education experience helps to shape the attitudes and professionalism of ATS. Students

exhibited collegiality, interpersonal communication, and respect for each other throughout the PBL experience as demonstrated throughout the PBL study (Figure 29)

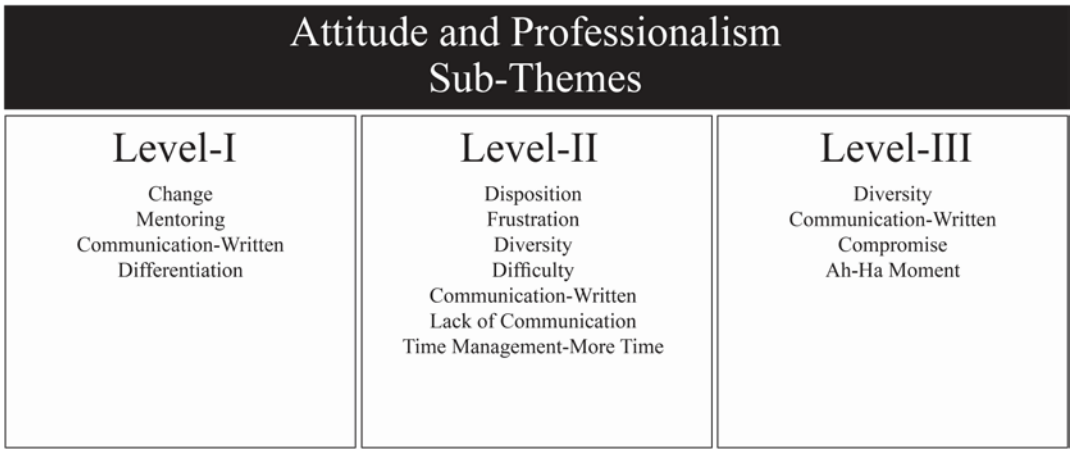


Figure 29 Attitude and Professionalism Sub-Themes

Level-I results. The athletic training student begins the professional assimilation process in the first complete year of the AT program. Level-I attributed change as the biggest factor for the development of their attitude and professional behavior. The students believe the introduction of a mentor would have helped facilitate their professional assimilation. Chickering's and Reisser's environmental factors play a significant role in the development of the level-I AT student. Chickering and Reisser note students need to have accessible and authentic interaction with AT faculty (Evans et al., 2010). The L-1 student's identified this as the role of a mentor modeling the specific behavior.

Formal assimilation/socialization follows a structured program developed by faculty as reported by Mazerolle, Bowman and Dodge (2014). In the research performed by Mazerolle, Bowman, and Dodge they noted formal assimilation occurs through the programmatic design using introductory courses, observational hours, orientation sessions, handbooks and organized peer mentoring (2014). Clinical preceptors model the professional behavior and attributes needed by the AT student. Modeling by the supervisor is performed under direct supervision of the AT student. Direct supervision is defined as constant audio, visual, and verbal contact (Sexton, Levy, Willeford, Barnum, Gardner, Guyer & Fincher, 2009; Evans et al., 2010; Sexton 2011, Mazerolle, Bowman, and Dodge, 2014).

Level-II results. Disposition was the most frequent sub-theme discovered through data analysis Level-II students had a difficult time with professional assimilation and development. The overall disposition was one of frustration, also a sub-theme. The level of difficulty of the PBL intervention also seemed to have affected the disposition of the students. Time management also weighed heavily on how they approached the three interventions. Intervention number two was marred by the general disposition of each student. One student was left out of the intervention while another was extremely frustrated and refused to work through the problem. This is opposite of the small group collaboration model presented by Schmidt, Rotgans, & Yew, (2011). Furthermore, the disposition of the students, in this case, indicate a lack of development in the Perry and Chickering theories. The displayed behavior appears to take steps in a negative direction for development rather than equipping the students with the necessary professional

collaboration skills (Evans et al. 2014). Developing collegiality among peers is one of the primary goals of the small group models. L2-D reflection journal notes that attitude plays a significant role in the intervention (Figure 30).

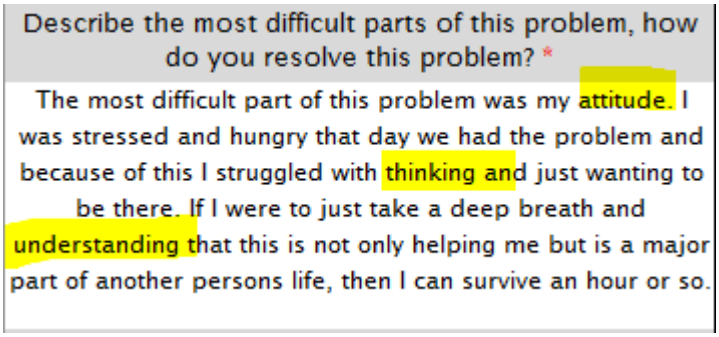


Figure 30 Reflection Journal LII-D
Note. The most difficult part of this problem was my attitude. I was stressed and hungry that day we had the problem and because of this I struggled with thinking and just wanting to be there. If I were to just take a deep breath and understanding that this is not only helping me but is a major part of another person's life, then I can survive an hour or so.

L2-D stated, "If I were to just take a deep breath and understanding that this is not only helping me but is a major part of another person's life, then I can survive an hour or so." The researcher appreciates the student ending this reflection piece with this statement. The overall impression of the reflection by L2-D is one of "poor me" focused solely around the attitude of the student, as recognized by L2-D. Through the process of reflection, L2-D demonstrated the ability to adapt and reflect in a positive manner how his disposition plays a role in how others react and interact in a small group setting. This shows the development of maturity and a willingness to adapt.

Captured in the following Level-II focus group transcript, this dialog answers a question on the effects of group dynamics. While the question was targeting group dynamics, the student's attitude and professionalism were highlighted as a significant problem in the group.

Moderator: Tell me about your group dynamics.

L2-B: Hindered us because we were all pretty grumpy. We wanted to get in find the answer and get out.

L2-C: I just shut down and sat there, because I was grumpy, in a mood, and I thought it (the problem solution) was something and let them (others in the group) do their thing.

MODERATOR: Do you think the time of day has a significant influence in how well the group works together.

L2-C: I would say so because we all have busy schedules. We were all in bad moods

L2-A: It's Dinner, let's do this, get out of here, take a shower, do homework, so we can go to bed early.

L2-C: Other external factors that we brought in. I think all of that together makes a difference.

MODERATOR: If you were to finish your degree right now (with everything you know) no more school, and you had to go into a situation where you had to work with a group of people after a long day, how does that prepare you for a real life situation?

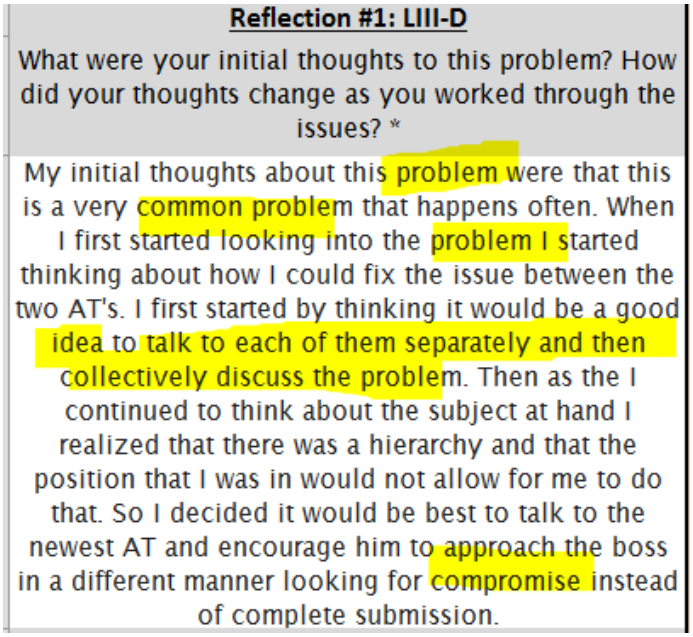
L2-A: For me it wasn't interacting, it was the end of the day, mentally. But even the first week I was ready and go at it. Last week I was just mentally weak. If I would still have the same attitude.

L2-C: In a real world problem would act differently. This is a study, and we would get this so we can go home.

L2-E I would probably act the same

This dialog between the moderator and students clearly indicates their general disposition played a significant role in the development of attitude and professionalism (Schmidt, Rotgans, & Yew, 2011). They also could not see the role PBL plays in the development of their professional attitude. Chickering's theory identifies this as the developing mature interpersonal relationships in which the student develops an understanding and acceptance of differences between individuals and circumstances in a learning environment. L2-C even referred to the fact this was not a real situation, whereas L2-E claims the attitude would remain the same. The aforementioned dialogue clearly indicates environmental and personal factors play a significant role in the development of the student-specific to a tutoring intervention using PBL (Dochy, Segers, Van den Bossche, and Gijbels, 2003Evans et al., 2010).

Level-III results. The first intervention Level-III encountered involved a problem specifically addressing attitude and professionalism. This specific problem involved a recent graduate who was working alongside an AT with years of experience. This problem presented the two professionals in the midst of a strong disagreement regarding the progression of treatment/rehabilitation protocol. The following reflective journal entries provide a snapshot of the professionalism the Level-III students displayed (Figure 31 & 32).



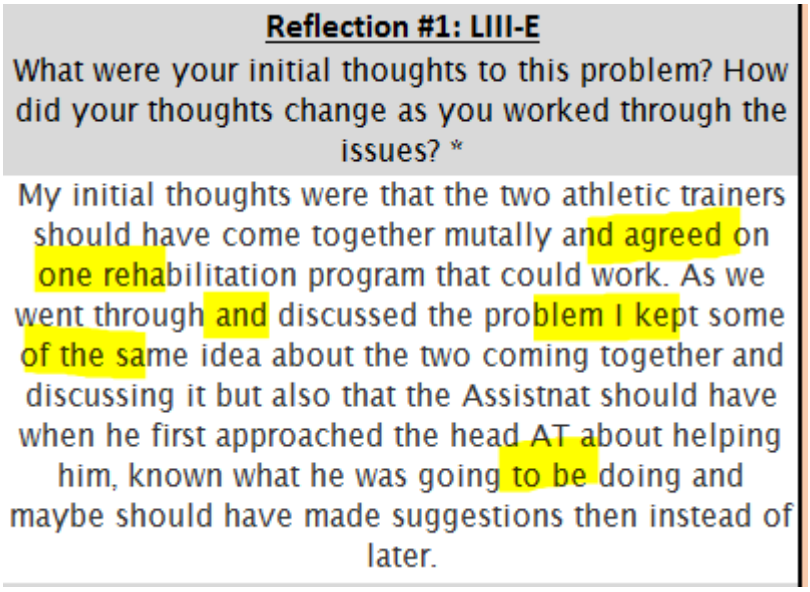
Reflection #1: LIII-D

What were your initial thoughts to this problem? How did your thoughts change as you worked through the issues? *

My initial thoughts about this problem were that this is a very common problem that happens often. When I first started looking into the problem I started thinking about how I could fix the issue between the two AT's. I first started by thinking it would be a good idea to talk to each of them separately and then collectively discuss the problem. Then as the I continued to think about the subject at hand I realized that there was a hierarchy and that the position that I was in would not allow for me to do that. So I decided it would be best to talk to the newest AT and encourage him to approach the boss in a different manner looking for compromise instead of complete submission.

Figure 31 Reflection Journal LIII-D[2]

Note. My initial thoughts about this problem were that this is a very common problem that happens often. When I first started looking into the problem, I started thinking about how I could fix the issue between the two AT's. I first started by thinking it would be a good idea to talk to each of them separately and then collectively discuss the problem. Then as I continued to think about the subject at hand, I realized that there was a hierarchy and that the position that I was in would not allow for me to do that. So I decided it would be best to talk to the newest AT and encourage him to approach the boss in a different manner looking for compromise instead of complete submission.



Reflection #1: LIII-E
What were your initial thoughts to this problem? How did your thoughts change as you worked through the issues? *
My initial thoughts were that the two athletic trainers should have come together mutally and agreed on one rehabilitation program that could work. As we went through and discussed the problem I kept some of the same idea about the two coming together and discussing it but also that the Assistnat should have when he first approached the head AT about helping him, known what he was going to be doing and maybe should have made suggestions then instead of later.

Figure 32 Reflection Journal LIII-E[2]

Note. My initial thoughts were that the two athletic trainers should have come together mutually and agreed on one rehabilitation program that could work. As we went through and discussed the problem I kept some of the same idea about the two coming together and discussing it but also that the Assistant should have when he first approached the head AT about helping him, known what he was going to be doing and maybe should have made suggestions then instead of later.

This professional conduct problem exposed the Level-III student to the need for respectful collegiality while at the same time being an advocate for the proper evidence-based treatment/rehabilitation plan. Focus group discussions responses indicated how this problem helped them with professional assimilation:

> L3-A: I think for this problem, it was a good thing to be in a group to discuss how we would handle the situation before we are placed in that situation as professionals. It gives us a pattern to know what we might do and how we might handle a situation.
>
> L3-B: Also requires to look at the problem from several angles and your first instinct. Working together allows you to see this and come to a best conclusion.

> L3-C: makes you look at research as to what it says. It gives you the tools to know how you would handle the problem. I will be leaving soon out of state. I may have a different view of a colleague, and I will have had some experience in knowing how to handle the situation with the colleague.
>
> L3-D: Problem led to a similar situation we had to discuss and how we would address the situation. Helped with us and how we would use it in a day to day situation. We had to access each person's opinions and developed compromises to understand one another. It helped with our thought processes.

These students demonstrate the professional traits desired by the knowledge and skills associated with the treatment/rehabilitation domain (BOC, Inc., 2011). Level-III students displayed exceptional professionalism and developed collegiality through the small group setting (Schmidt, Rotgans, & Yew, 2011). The behavior and development of the Level-III students align well with Perry's positional theory on student development. Attitude and professionalism can be identified within Perry's theory as transitioning out of relativism and proceeding to commitment. Students realize the ability to act on knowledge, show maturity within the context of the PBL exercise, and show stability and flexibility, all of which are traits demonstrated through attitude and professionalism (Barrows & Kelson, 1995; Evans et al., 2010).

Qualitative Data Summary

Reflecting on the five major themes, as guided by EMCR pre/post-test assessment, Self-Directed learning was neglected more than the other themes. Novice students struggled throughout the initial stages of the intervention. However, by the last week, Level-I students had become more comfortable with the process and were able to see a difference from the first week of the study. Level-II students had difficulty with collaboration and attitude/professionalism. These students had trouble looking past individual problems and did not create the positive peer environment that is needed for small group collaboration (Schmidt, Rotgans, & Yew, 2011). Level-III students were significantly more engaged and willing to experience healthy interactions. These findings correlate with those of Palmer et al. (2000), Facion (Cited in Pascarella & Terenzini, 2005), and Hood & Deoprer (2002) where students made the most significant improvements in development from first year to final year through Perry's positional development theory.

Throughout the constant comparative analysis of the qualitative data, the top three sub-themes presented were cognitive process/metacognition (Application of Knowledge), problem-solving (Clinical Reasoning), and research (Self-Directed Learning). These three sub-themes repeatedly appeared throughout focus group and reflection journals. The research was the one reoccurring sub-theme that had a major impact on the students. Each level remarked how the need for research was essential for solving the problem. Initially, this was not the case, but as students engaged in the intervention, they began to see the necessity research plays in developing an appropriate

treatment/rehabilitation plan. Students began the process of moving theory into practice (Norman & Schmidt, 1992). The final qualitative analysis ranks the five PBL objectives based on how students perceived the PBL intervention affecting their performance. Student perceptions were ranked based from greatest (most effective) to least effective perceptions.

1. Application of Knowledge
2. Clinical Reasoning
3. Attitude/Professionalism
4. Collaboration
5. Self-Directed Learning

Convergence of Data

Data analysis from the EMCR pre/post-test self-assessment provided quantitative measures regarding how student's perceived their learning abilities within the PBL intervention, whereas; the focus groups and reflection journals provided the qualitative meaning behind how the students engaged in the intervention (Figure 33).

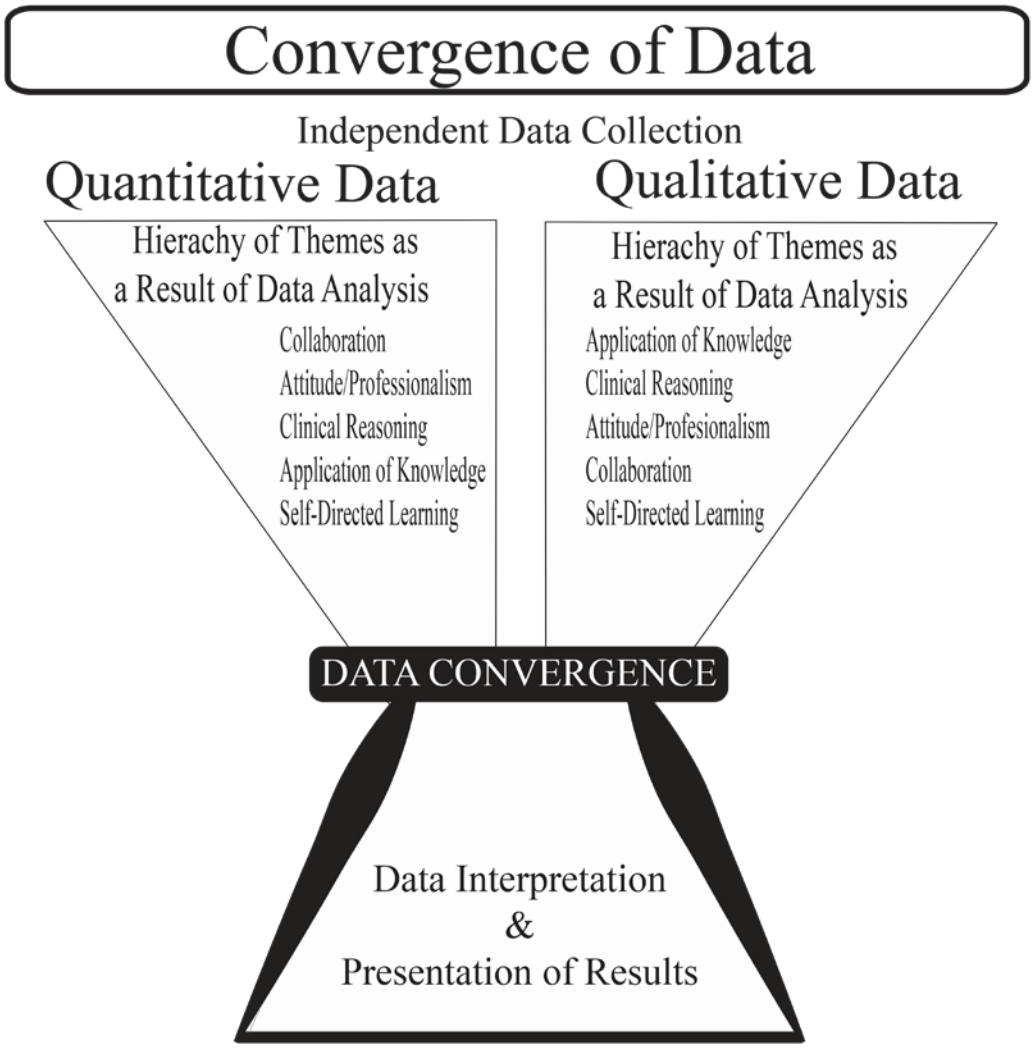


Figure 33 Convergence of Data Sources
Note. The quantitative and qualitative data is independently analyzed and then converged for data interpretation and presentation of the results. Convergence (triangulation) of the quantitative and qualitative data helped identify how the PBL may or may not lead to the narrowing of the theory application gap within the treatment and rehabilitation domain. Each data set was independently analyzed as reported in the previous sections.

Study Question One

Does a tutoring intervention using the PBL instructional theory provide RU students in the ATE Program the knowledge and skills necessary to apply the theoretical information into practical application? The purpose of this question was to gain an understanding on how students integrated knowledge and skills into clinical practice. The major themes from the qualitative datum are *Application of Knowledge, Clinical Reasoning*, and *Self-Directed Learning.*

- Student interviews from focus groups indicate an overall positive experience with the application of knowledge and self-directed learning. The scores represented for each level of the EMCR self-assessment state otherwise as demonstrated by a combination of the scores on the EMCR (Table 18) Clinical Reasoning was the only major theme in which both the qualitative and quantitative measures align.

EMCR Themes	Minimum Score	Maximum Score	Mean	EMCR Rating Scale
Application of Knowledge Pre	27.00	40.00	33.40	Fair
Application of Knowledge Post	15.00	45.00	35.13	
Clinical Reasoning Pre	36.00	56.00	46.26	Excellent
Clinical Reasoning Post	20.00	59.00	47.93	
Self-Directed Pre	27.00	46.00	31.26	Poor
Self-Directed Post	16.00	40.00	30.80	

Table 18 Study Question One Scores
Combination of scores for Level-I, Level-II, and Level-III Note. Pre/posttest for major themes application of knowledge, clinical reasoning, and self-directed learning.

- When analyzing the data from the quantitative and qualitative measures, there are conflicting findings. Focus groups identified the application of knowledge within the PBL intervention as an area in which they grew as learners; however when completing the EMCR self-assessment, students in all levels returned a result of *"Fair"*. This shows a discrepancy between the quantitative and qualitative data.
- Clinical Reasoning is supported by the qualitative analysis. Students stated they were able to see the added benefit of the PBL intervention in developing their clinical reasoning skills. AT students must learn to develop clinical judgment, as well as decision-making and problem-solving skills (Geisler & Lazenby, 2009). Throughout the implementation of the PBL intervention in the treatment and rehabilitation domain, each academic level was given problems that would foster the development of clinical reasoning. Geisler and Lazenby (2009) identified the experience, clinical thinking, as well as differential diagnosis, as elements necessary for developing clinical reasoning. The design of the PBL intervention provided students with a 30-45 minute window to work collaborative and/or independently. During this time, the learner (student) should develop an effective clinical reasoning process (Barrows, 1994 & 1995). The Board of Certification Inc., (2011) states students should be able to apply clinical reasoning skills to select appropriate assessment, treatments, and rehabilitative plans in regards to a patient's injury/illness.

- Through the convergence of data, a tutoring intervention in PBL *is inconclusive in determining whether or not the intervention provides the knowledge and skills necessary to apply the theoretical information into the practical application.*

Study Question Two

The Researcher wanted to know how students reacted to the practice of PBL as a means to promote self-directed learning (Table 19). The major qualitative themes aligning to study question two are *Self-Directed Learning*, and *Attitude.*

EMCR Themes	Minimum Score	Maximum Score	Mean	Rating Scale
Self-Directed Pre	27.00	46.00	31.26	Poor
Self-Directed Post	16.00	40.00	30.80	
Attitude Pre	46.00	60.00	50.40	Excellent
Attitude Post	31.00	64.00	49.00	

Table 19 Study Question Two Scores
Combination of scores for Level-I, Level-II, and Level-III Note. Collaborative scores for pre/posttest for major themes self-directed learning, and attitude and professionalism.

- Students in all academic levels rated their self-directed learning in the "Poor" category on the EMCR self-assessment. This is supported with the qualitative findings. Students had difficulty with the concept of self-directed learning. Qualitative evidence supports novice learners had more difficulty with self-directed learning and were unable to engage effectively with the problems. However, over the course of the intervention, the novice began to see how changing their engagement practice could be a benefit.

- Students remarked they did not see a change in their engagement practices. Students were quoted, saying they are “lazy” and “sometimes just do not care”. One student even remarked how she shows up and hopes to “soak it all in.”
- On the whole, the qualitative analysis indicates that attitudes were excellent. A caveat to note is the difficulty Level-II had within one of the interventions. This did not change their perceptions of engagement within the EMCR; however, the focus group and reflective journals suggest otherwise.
- Self-directed learning promotes connecting the content to application, as well as aiding the student in formulating learning goals and strategies (Abraham, Upadhya, and Ramnarayan, 2005, Amador, Miles, & Peters, 2006). Students were unable to appreciate fully the benefits of self-directed learning within the PBL intervention.
- Through the convergence of data, a tutoring intervention in PBL *did not change the content engagement practices of RU students.*

Study Question Three

"How do students rate themselves on a pre and post self-assessment in a PBL intervention?" The researcher wanted to know how they perceived their abilities within the PBL intervention (Table 20).

EMCR Themes	Mean	Minimum Score	Maximum Score	Rating Scale
Application of Knowledge Pre	33.40	27.00	40.00	Fair
Application of Knowledge Post	35.13	15.00	45.00	
Clinical Reasoning Pre	46.26	36.00	56.00	Excellent
Clinical Reasoning Post	47.93	20.00	59.00	
Self-Directed Pre	31.26	27.00	46.00	Poor
Self-Directed Post	30.80	16.00	40.00	
Collaboration Pre	47.13	35.00	59.00	Excellent
Collaboration Post	49.40	30.00	63.00	
Attitude Pre	50.40	46.00	60.00	Excellent
Attitude Post	49.00	31.00	64.00	

Table 20 Study Question Three Scores
Note. Collaborative scores for pre/posttest for the EMCR in Level-I, Level-II, and Level-III

- The qualitative data analysis supports the findings of the quantitative data as seen in the EMCR pre/post-test self-assessment.
- Students from all levels indicated they had difficulties with the application of knowledge and self-directed learning.
- Application of knowledge did see an increase in the collective mean from pre to post-test assessment. This is supported by feedback provided through focus groups and reflective journaling. All levels had a slow start to the intervention.

However, the qualitative data presented indicated students were able to make the appropriate adjustments and improve in the area of application of knowledge.

- Self-Directed Learning had a decrease in score from pre to post-test assessment. The drop in score is not significant. However, it does indicate students are aware they struggle with developing themselves. This is supported by qualitative data. Novice learners had the most difficulty identifying with self-directed learning.
- Langendyk (2006) identifies self-assessment as an essential PBL facet within medical education. PBL implementation requires the student to practice self-reflection and assessment of their ability to successfully navigate real world problems.
- The ability of the student to perform self-assessment is another tool used in the development of the life-long learner. Developing a life-long learning attitude requires students to have the ability to take ownership of their learning. Ozogul and Sullivan (2007) believe the use of self-assessment provides greater participation of students when learning takes place.
- Through the convergence of data, a tutoring intervention in PBL demonstrated that students *accurately rated themselves on a pre and post self-assessment as compared to the qualitative data.* Self-Directed learning was identified through both data measures as the one area of significance where the PBL intervention did not influence their engagement practice.

Study Question Four

"How does a PBL intervention in the ATE program change the collaborative exchange among students within the classroom and clinical field experiences settings?"

- A key response to answering this question identified the "safe environment" PBL offers students. PBL offers the opportunity to have problem cases outside of the clinical practice setting allowing the ATS to practice safe clinical practices prior to being unleashed on real patients.
- Here students identified both the pros and cons of the PBL intervention. Pros were identified as using a step-by-step process to learning and the understanding of "why". Cons of the PBL tutoring intervention included working within the group dynamic setting, time and the long process of solving a problem
- Small Group Collaboration promotes collegial development among peers, increases contact with the PBL tutor, and generates positive peer pressure to meet the needs of the group, develops effective communication among peers (Schmidt, H.G., Rotgans, J., & Yew, E. 2011)
- Through the convergence of data, a tutoring intervention in PBL demonstrated a *positive exchange in collaboration among students within the classroom and clinical field experiences settings?*

Central Research Question

"How does a tutoring intervention in PBL narrow the theory application gap within the BOC, Inc. treatment and rehabilitation domain in an undergraduate athletic training education program at Regional University in Texas?"

Professional preparatory programs often experience what Allen & Wright (2014) calls a "huge disparity between the types of skills and knowledge taught in pre-service programs and the realities of workplace practice" (p. 136). This disparity can lead to a theory-practice gap also called the theory application gap. The theory application gap exists when a breakdown occurs between the classroom (theory) and clinical practice (application) integration. This phenomenon is well documented in teacher education programs and nursing education, as noted in research conducted by Baxter, (2007), Streveler, (2013), and Allen (2014). Streveler (2013) conducted the only study of student perceptions of the theory application gap in ATE. Streveler noted ATE students do perceive a gap between theory and practice and tend to rely more on the clinical setting where the "real" practice is taking place.

The Theory Application Gap at Regional University.

The thematic deficiencies noted in the study performed by Carr (2011) revealed post-graduate (3-5 years) AT students had several insufficiencies including interpersonal communication, decision making/independence, initiative, confidence, and ability to learn from mistakes. Carr's (2011) research implies a gap between theory and practice. Streveler (2013) performed the first study of the theory application gap specific to ATE. Streveler noted 62% of students completing her study indicated there was a perceived gap in theory and practice.

Carr (2011) and Streveler (2013) both conclude a gap within the ATE, and their findings also support the student development theories of Chickering & Perry (Evans et al. 2010). Carr's research points more directly toward Chickering's theory as the

insufficiencies described in the seven vectors are closely related. The 21st Century AT student has to understand the process of development to help avoid the gap in learning. As the student progresses through Chickering's vectors and Perry's positions growth and development occurs leading to a narrower gap between theory and application.

Mazerolle, Bowman, and Dodge (2014) noted how programs work to build relationships with their AT cohorts. Chickering identifies this as *Student-Faculty Relationships, Institutional Objectives, and Friendships and Student Communities* (Evans et al., 2010). Furthermore, Perry's scheme allows for students to progress through the positions as relationship and understanding of one another develop over the course of the academic career (Evans et al., 2010)

Mazerolle, Bowman, and Benes (2014) conclude professional assimilation/socialization occurs over the course of the student's time within the AT program. Structuring the professional assimilation into formal and informal themes allows students to develop over the course of time. Research conclusions by Mazerolle, Bowman, and Benes (2014) provides a connection between AT professional assimilation/socialization and the theories presented by Chickering and Perry

During the focus group sessions students at Regional University (RU) were asked if they perceived a gap between theory and practice, 100% of the student participants (N=15) communicated there was some form of gap present between the classroom and clinical, educational settings. To answer the central question RU students were asked to describe the effects of the PBL tutoring intervention (Figure 34)

Level-I	Level-II	Level-III
How do you think PBL fits into ATE?	**Do you think PBL increased or decreased knowledge and skills that you learned in the classroom and were you able to apply this knowledge/skills into practice?**	**What do think of PBL as a tutoring intervention?**
L1-B: I think it shows you "just because" isn't right. I feel like I need to look harder at what I am doing. I need to more effort in what I am doing and less on what I have seen.	L2-D: I think it increased our ability to decipher what was going on. How much skill wise, I don't think there is a correlation with the skills part, because so many of us are visual learners. But for the actual critical thinking it definitely has increased.	L3-A: I think that it would decrease the gap in application. The one thing that helped a great deal was prior knowledge
L1-A: I think that I need to work on what I am not very good at. High school was a breeze and it was remember for the test, forget it, remember for the test forget itת but now its like I have to remember things. I have been on this bad habit for my life and now I will just write it down and not know what I wrote it. I just take notes... and that's it. I never did any extra to explain my questions I might have so I think you need to do this.	MODERATOR: What about treatment/rehab plans?	L3-B: It helped us and it is important to build upon prior knowledge.
L1-C: I think these PBL sessions are teaching how to think about a problem and tie everything together. What we get in class you memorize facts/figures/details remember for the test ת you might remember something for the clinic and you might not. Where PBL is showing us how to take everything we know and working through a problem rather than randomly guessing and saying we think we know	L2-D: It has given me assurance that I can produce treatment/rehab. And for more difficult rehabs, I know that I can go and research what I need to do based on evidence. I can figure out how to search for reliable evidence.	L3-C: As long as you have a good basis PBL then I think it can help in all areas. I think it has to be educated to the facilitators and students to make sure they understand the process.
L1-D: In class we don't learn why we do what we do, we just learn what to do		L3-A: In PBL 2-3 both answers were things we had never seen before, so with PBL you have the ability to present a problem that is uncommon and help them work through the problem. It broadens the range the student encounters.
L1-B: I don't think before this I realized that we aren't learning why.		L3-B: Even though we haven't seen this in the clinic I feel like after the last two problems if I were to see this then I would be able to handle this problem.

Figure 34 Focus Group Transcript
Note. Student responses regarding the PBL tutoring intervention effectiveness in decreasing the theory application gap.

- The greatest take away from the Level-I focus group was how the PBL intervention taught them the "why" behind the problems within the treatment/rehabilitation domain. Level-I students recognize there is a gap in theory and practice. They equate learning to studying for a test and receiving a passing grade without the notion of needing to recall the information later. L1-B

stated it best, "…I realized that we aren't learning why". The PBL intervention helped to teach Level-I students how to think about problem-solving and bring all their knowledge together to solve a problem.

- Level-II students all agreed there was is a theory application gap present within the treatment/rehabilitation domain, but only L2-D provided insight to this level's response. L2-D believe the PBL intervention was more beneficial for critical thinking skill development and not a good source for clinical skills growth. Level-II students did not reflect on the "why" factor identified by Level-I, rather one individual noted the PBL intervention gave him the assurance he needed for solving the problems of developing a treatment/rehabilitation plan.
- Prior knowledge integration was identified by Level-III as the greatest benefit for narrowing the theory application gap. This is understandable because the Level-III students were completing their final semester within the ATE program. Additionally these students had a previous experience with PBL during the pilot study. Building upon prior knowledge was critical for the Level-III students when solving their problems. These students also recognize how PBL allows for the integration of uncommon injuries/illnesses. L3-B reflected, "Even though we haven't seen this (injury) in the clinic, I feel like after the last two problems, if I were to encounter these injuries I would be able to handle this problem."
- Through the convergence of data a tutoring intervention in PBL demonstrated *a theory-application gap does exist at Regional University. It is noted through*

student focus group reflection that RU AT students believe PBL to be an effective means to decrease the theory application gap.

Conclusion

The uniqueness of PBL allows for a curriculum to be differentiated from diverse levels of learners (Hmelo & Silver, 2010). Novice learners can begin the PBL process in their introductory courses allowing for familiarization of problem-solving. Through the progression of a PBL curriculum the goal becomes to enhance student learning through scaffolding -- bridging the gap from novice to a competent entry-level professional. Noted in Chapter II is of the development of the college student is critical to learning over time and progressing from novice to expert. Equipping students through facilitation of growth as described in the Chickering and Perry theories will assist in the holistic development. PBL allows for the tailoring of the curriculum to satisfy the needs of varying academic levels within ATE. The result is through scaffolding previous knowledge to solve the problem and develop new knowledge (Schmidt, H.G., Rotgans, J., & Yew, E. 2011). Thus, PBL provides a learning over time paradigm that enriches student development. This is evident in the differences noted between Level-I and Level-III focus group & reflective journal comments. Novice learners begin to experience the process of scaffolding within these foundational courses and develop the metacognitive and reflective skills introduced through the PBL curriculum (Hmelo & Silver, 2004). Progressing through PBL curriculum students should begin to develop deeper understanding of problem-solving, self-directed learning, and collaborative efforts moving from novice to proficient and ending with competency.

CHAPTER V

DISCUSSION, RECOMMENDATIONS, AND CONCLUSIONS

Introduction

The instructional strategy of Problem-Based Learning (PBL) was used as a tutoring intervention to determine if PBL had an effect on narrowing the theory application gap within the BOC, Inc. treatment and rehabilitation domain at Regional University in Texas. This mixed method research study traced the historical perspective of athletic training education and education reform, provided a constructivist theoretical approach for instruction, and used the theory application gap as the theoretical framework to guide this research. In this chapter, an overview of research will be presented followed by a summary of findings. Practical implications will be discussed for the following entities: Regional University, curriculum and instruction designers in athletic training educators, The BOC, Inc. treatment/rehabilitation domain, and interdisciplinary implications for professional educators. A brief discussion on future research is presented prior to the concluding thoughts for this research study.

Research Overview

Creswell (2011) believes mixed method research must provide a real-world approach for the researchers. Utilizing this real-world approach to data collection enabled the researcher to evaluate whether a tutoring intervention using PBL was capable of providing an effective instructional strategy to narrow the theory application gap. This mixed methods study aimed to answer the central research question: How does a tutoring intervention in PBL narrow the theory application gap within the BOC, Inc.

treatment and rehabilitation domain in an undergraduate athletic training education program at Regional University in Texas? The sub-questions of this research study were:

Q1: Does a tutoring intervention using the PBL instructional theory provide RU students in the ATE Program the knowledge and skills necessary to apply the theoretical information into practical application?

Q2: How does PBL in the ATE program change the content engagement practices of RU students within a formal tutoring intervention?

Q3: How do students rate themselves on a pre and post self-assessment in a PBL intervention?

Q4: How does a PBL intervention in the ATE program change the collaborative exchange among students within the classroom and clinical field experiences settings?

The study was conducted at Regional University (RU) in Texas. The university is a private liberal arts university and is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools. The Athletic Training Education (ATE) program is a division within the Fitness and Sports Science Department. Participants consisted of 15 athletic training students (ATS) who volunteered to take part in this study conducted during five weeks in the spring 2013 semester.

The convergent design for mixed method data collection and analysis was utilized to obtain differing data sets covering the same research topic (Creswell & Plano-Clark, 2011). Ostlund et al., (2011) identified convergence as the preferred recommendation to identify the linkage between theory and application of the methods.

Quantitative data collection was obtained through the Elizondo-Montemayor Criterion-References (EMCR) system for self-assessment in PBL (Elizondo-Montemayor, 2004). The EMCR was used as the pre and posttest quantitative instrument and is a specific assessment to evaluate the five objectives of PBL: 1) Application of Knowledge, 2) Clinical Reasoning and Decision Making Skills, 3) Self-Directed Learning, 4) Collaborative Work, and 5) Attitude and Professionalism.

Quantitative data was exported from SurveyMonkey® and initially organized in Microsoft Excel where descriptive statistics were performed. Once the descriptive analysis was complete, the data were exported for advanced statistical analysis using the PASW statistical package. Advanced statistics performed on the EMCR included the Kruskal-Wallis statistical analysis identifying any statistical significance by comparing the three groups, followed by the Kruskal-Wallis analysis and a posthoc Mann-Whitney U analysis was performed to analyze where the differences lie between the means of the paired PBL objectives and the academic levels.

Qualitative data were collected through focus group sessions and reflective journal entries. Focus groups were held one week after each PBL intervention for three weeks. Reflective journals were conducted concurrently with the PBL intervention. Qualitative analyzes were performed through process coding of the data sources. Creswell and Plano-Clark (2011) describe qualitative analysis through coding of the data, thematic grouping, labeling of codes, interrelating themes, and using qualitative software programming. Saldana (2011) describes coding of data as a "method of discovery" (p. 95). It is through this method of discovery that "these coded function as a

way of patterning, classifying, and later organizing each datum into emergent categories for further analysis (Saldana, 2011, p. 95). The process of coding allows the researcher to give a "name" to the data as they are presented. As noted by Saldana (2009) a code is "most often a word or short phrase that assigns a summative, essence capturing attribute for a portion of language or visual data" (p. 3). Additionally, qualitative data were examined through constant comparison analysis of the focus groups and reflection journals. Through the constant comparison analysis, the five PBL objectives assessed in the EMCR were used to identify the overarching themes of the qualitative data. Sub-themes were identified for each central theme and were instrumental in supporting the central themes**.**

Summary of Findings

This study explored the effects of PBL as an intervention for narrowing the theory application gap in the Board of Certification, Inc. treatment and rehabilitation domain at Regional University in Texas. A brief summary of the qualitative and quantitative data and the convergence of both data sets are presented in this section.

Quantitative Data Results

Through quantitative data analysis, the results of the EMCR pre/post-test self-assessment, ranked the PBL objectives from strongest to weakest as illustrated in table 21. Statistical analysis designates the area of Self-Directed Learning as the lowest rated objective at all three academic levels, with a statistical significance reported in their post-test assessment comparison. Research in PBL indicates self-directed learning to be a key area of development for students (Barrows, 1994, McLoda, 1996, Catlaw, 1999,

and Dochy et al. 2003). *Attitude and Professionalism* resulted in the highest scored areas of the EMCR. The results of the statistical analysis did indicate some improvement in *Attitude & Professionalism* but lacked statistical significance to indicate the PBL intervention had a noteworthy benefit.

EMCR Themes	Chi-Square (χ2)		df	Asymp. Sig	
	Pre	Post	2	Pre	Post
Attitude & Professionalism	5.554	5.173	2	0.062	0.075
Collaborative Work	0.548	5.439	2	0.76	0.066
Clinical Reasoning	1.862	6.477	2	0.394	0.394
Application of Knowledge	1.538	3.288	2	0.463	0.041
Self-Directed Learning	3.072	7.36	2	0.215	0.021

Table 21 EMCR Results Level-I, II, III
Note. Rank-order Kruskal-Wallis pre/posttest results p=0.025

Qualitative Data Results

Qualitative data were analyzed by focus group and reflective journal transcripts. The final qualitative analysis ranks the five PBL objectives based on how students perceived the PBL intervention affecting their performance within the five PBL objective. Student perceptions were ranked based from greatest (most effective) to least effective perceptions.

1. Application of Knowledge
2. Clinical Reasoning
3. Attitude/Professionalism
4. Collaboration
5. Self-Directed Learning

Reflecting on the five major themes, as guided by EMCR pre/post-test assessment, Self-Directed learning was neglected more often than the other themes.

Novice students struggled throughout the initial stages of the intervention. However, by the last week, Level-I students had become more comfortable with the process and were able to see a difference from the first week of the study. Level-II students had difficulty with collaboration and attitude/professionalism. These students had trouble looking past individual problems and did not create a positive peer pressure environment that is welcomed for small group collaboration (Schmidt, Rotgans, & Yew, 2011). Level-III students were significantly more engaged and willing to experience healthy interactions.

Throughout the constant comparative analysis of the qualitative data, the top three sub-themes presented were cognitive process/metacognition (Application of Knowledge), problem-solving (Clinical Reasoning), and research (Self-Directed Learning). These three sub-themes repeatedly appeared throughout focus group discussions and reflection journals. The research was the one reoccurring sub-theme that had a major impact on the students.

Each level remarked how the research was essential for solving the problem. Initially, this was not the case, but as students engaged in the intervention, they began to see that research plays a critical role in developing an appropriate treatment/rehabilitation plan. Students began the process of moving theory into practice (Norman & Schmidt, 1992).

Convergence of Data

Data analysis from the EMCR pre/post-test self-assessment provided quantitative measures regarding how student's perceived their learning abilities within the PBL intervention. The focus groups and reflection journals provided the qualitative meaning behind how the students engaged the intervention. The convergence of the data (Quantitative and Qualitative) revealed inconclusive results for the use of a PBL intervention as an avenue to decrease the theory application gap. Tables 22 and 23 provide a summary of the overall findings.

Question	Findings
Central Question: How does a tutoring intervention in PBL narrow the theory application gap within the BOC, Inc. treatment and rehabilitation domain in an undergraduate athletic training education program at Regional University in Texas?	1. Student interviews from focus groups recognize the presence of a theory application gap within the ATE at RU. 2. Student's interviews from focus group indicate the use of a tutoring intervention in PBL as a positive step forward to decreasing the theory application gap at RU. 3. Through the convergence of data a tutoring intervention in PBL demonstrated a theory-application gap does exist at Regional University. It is noted through student focus group reflection that RU AT students believe PBL to be an effective means to decrease the theory application gap.
Q1: Does a tutoring intervention using the PBL instructional theory provide RU students in the ATE Program the knowledge and skills necessary to apply the theoretical information into practical application?	1. Student interviews from focus groups indicate an overall positive experience with application of knowledge and self-directed learning, the scores represented for each level of the EMCR self-assessment state otherwise as demonstrated by a combination of the scores on the EMCR 2. A discrepancy between the quantitative and qualitative data findings for the application of knowledge is present. Qualitative data suggests students experience growth as learners. EMCR results show the application of knowledge as *"Fair."* 3. Through the convergence of data, a tutoring intervention in PBL *is inconclusive in determining whether or not the intervention provides the knowledge and skills necessary to apply the theoretical information into the practical application.*
Q2: How does PBL in the ATE program change the content engagement practices of RU students within a formal tutoring intervention?	1. Students in all academic levels rated their self-directed learning in the "Poor" category on the EMCR self-assessment. This is supported by the qualitative findings. 2. Students remarked they did not see a change in their engagement practices. 3. Through the convergence of data, a tutoring intervention in PBL *did not change the content engagement practices of RU students.*

Table 22 Summary of Findings: Central Question, Q1, Q2

Questions	Findings
Q3: How do students rate themselves on a pre and post self-assessment in a PBL intervention?	1. Qualitative data analysis supports the findings of the quantitative data as seen in the EMCR pre/post-test self-assessment. 2. Students from all levels indicated they had difficulties with the application of knowledge and self-directed learning. Through the convergence of data, a tutoring intervention in PBL demonstrated that students *accurately rated themselves on a pre and post self-assessment as compared to the qualitative data with regard to the PBL objective of self-directed learning. Other PBL objectives were inconclusive based on the convergence of data.*
Q4: How does a PBL intervention in the ATE program change the collaborative exchange among students within the classroom and clinical field experiences settings?	1. PBL offers the opportunity to have problem cases outside of the clinical practice setting allowing the ATS to practice safe clinical practices prior to being unleashed on real patients. 2. Small-Group Collaboration: promotes collegial development among peers, increases contact with the PBL tutor, and generates positive peer pressure to meet the needs of the group, develops effective communication among peers. Through the convergence of data, a tutoring intervention in PBL demonstrated a *positive exchange in collaboration among students within the classroom and clinical field experiences settings as indicated by the convergence of data.*
Table 23 Summary of Findings: Q3, Q4	

Practical Implications

Problem-based learning is a real-world instructional strategy that relies on student engagement. In order for students to be successful in narrowing the theory application gap, educators from all disciplines, must discover an instructional strategy to enhance student engagement. The PBL buy in factor must be presented as a real solution for students learning and their ability to apply new knowledge. The researcher suggests practical implications for (1) Regional University, (2) Curriculum & Instruction for AT

Educators, (3) BOC, Inc. Treatment & Rehabilitation Domain, and (4) Interdisciplinary implications for professional educators.

PBL Implications at Regional University

While the overall results of this study were inconclusive, a spirit of cautious optimism is present regarding PBL as an effective instructional strategy for narrowing the theory application gap in the treatment/rehabilitation domain. Regional University ATE desires to foster student success on the BOC, Inc. national certification examination. An implication of this study is the refinement of AT student development through the integration of PBL into the ATE curriculum not just in the treatment/rehabilitation domain. PBL can provide an opportunity for novice learners to develop metacognitive and reflective skills (Hmelo & Silver, 2004). Through continued implementation of the PBL instructional strategy students within the RU, ATE program should begin to develop deeper understanding of problem-solving, self-directed learning, and collaborative efforts moving from novice to proficient and ending with competency. This aspect of student-develop provides novice learners to grow into experienced clinicians. This is evident in the differences in how Level-I and Level-III student approached the problems. Greater care should be taken to foster the development of Level-I students' knowledge and the learning process to assist students understanding of problem-solving.

To fully appreciate the effects of PBL on the theory application gap, a longitudinal study should be conducted over several years with various cohorts. This would require a renovation of the current RU ATE curriculum and instruction. PBL does

take a commitment from the ATE faculty to learn the theory and to master the integration of the PBL strategy. Therefore, faculty should consider attending a workshop on PBL to prepare better them for the implementation. Initial PBL implementation should take place in the orthopedic evaluation courses as a supplement to the standard instructional strategy. Following this initial course integration, the RU ATE program should allow the PBL model to be gradually implemented in all classes, as faculty and students become more accustomed to the PBL instructional strategy. This could change the culture of learning within the RU ATE program while focusing on narrowing the theory application gap and developing competent athletic trainers.

This study specifically assessed how students apply new knowledge into clinical application, how students engage in the learning process, and the ability for students to narrow the theory application gap through a PBL tutoring intervention. The recommendations from the findings presented in this study are: (1) foster student engagement and (2) increase collaborative work.

Foster student engagement. Based on dialog from focus group transcripts students feel the current instructional practices within the RU ATE program does not foster an engaging atmosphere. Students often remarked there was little or no time for engagement activities that promote the application of knowledge within current courses. Students also felt adding a lab-based component to specific AT courses would provide additional support for developing clinical reasoning as well as enhancing applied clinical skills. The researcher recommends AT faculty evaluate current instructional methods and determine what instructional strategies can be implemented to provide additional

opportunities for engagement. Faculty should also consider alternative instructional strategies rather than the traditional lecture-based approach. Students often cited stories and instructor-centered lecture as the primary delivery medium for didactic information. Engagement can be accomplished through a variety of instructional strategies, not just PBL. The researcher recommends learning activities that will encourage student engagement both in the classroom and in the clinical field experience. The increased attention toward student engagement will help to foster self-directed learning, a trait all students in the study had difficulty developing.

Increase collaborative work. Research collected indicates that students enjoyed working in collaboration with peers. Currently, students are not afforded opportunities to participate in collaborative learning exercises. Students stated working in small groups allowed them to develop their ideas more freely while also hearing the opinions of others. Developing collegiality and professional assimilation can also be a benefit of collaborative work. Students should be given the opportunity to develop those relationships within a learning community where the exchange of ideas and research are shared for the betterment of each learner. The researcher recommends implementing a core concept into the ATE program where collaborative work is implemented in the ATE curriculum. Collaborative work should be fostered in each course within the curriculum whether the collaboration is in pairs or within a learning community. The researcher suggests AT faculty work together in developing interdisciplinary collaborative work as well. Creating an interdisciplinary approach can add to the clinical reasoning development as well as enhancing professional development.

PBL within Athletic Training Curriculum and Instruction

Previous PBL studies performed within athletic training education have focused mainly on the effects of PBL on critical thinking and decision making, traditional versus non-traditional instruction, the use within discovery learning, and as a viable instructional strategy (McLoda, 1996, Catlaw, 1999, Heinrichs, 2002, Mensch & Ennis, 2002, McGee 2003, Lesperance, 2008, German, 2008, Ryan, Murray, & Martin, 2009, and Gillette, 2011). Only one article in ATE, published by Smith-Goodwin and Wimer (2010), emphasized the use of PBL as an instructional strategy to connect the classroom with clinical experience. Smith-Goodwin and Wimer (2010) introduced the pedagogical framework used in a PBL curriculum showing the relationship PBL fosters between the classroom and clinical experience. No reference to the theory application gap is noted within any of the aforementioned studies as it pertains specifically to ATE.

Athletic Training Scholars must realize the theory application gap is the nemesis of transfer of learning and the application of knowledge within competency based ATE programs. This study was conducted with a small sample size and occurred over a short period of time. The results are mixed and inconclusive in regard to how a tutoring intervention in PBL can narrow the theory application gap. However, there are positive points to glean from the study reported here.

Potteiger, Brown, & Kahanov (2012) propose an adaptive athletic training curricular model where students enter a three phase approach to clinical competency. Phase one involves the pre-professional courses where PBL can be introduced as the instructional strategy for the foundational courses. This model demonstrates the courses

aligning with the TR domain to be considered foundational. Phase two, the professional phase, use a "holistic and problem-based approach to focus on a singular part or area" (Potterger, Brown, & Kahanov, 2012 p. 65). Here students are immersed into the subject matter through a holistic approach to caring for the patient. Phase three is considered the capstone experience where students are introduced to the clinical component of the degree program where skills developed through the PBL instructional strategy are put into practice in the clinical setting (Potteger, Brown, & Kahanov 2012).

Presumably the most significant implication PBL can have within AT curriculum and instruction is an understanding by the AT educator that PBL fosters student development as theorized by Chickering and Perry (Evans et al. 2010). Barrows & Kelson (1995) identified five goals for student achievement in PBL. When evaluating these goals from the perspective of student development one can clearly see how PBL can assist in narrowing the theory application gap simply by facilitating psychosocial, professional, cognitive, and interpersonal development.

PBL student-achievement goal 1: construct an extensive and flexible knowledge base. Chickering identifies this as developing competence through intellectual, physical and interpersonal growth (Evans et al. 2010). Whereas Perry's theory suggests, extensive and flexible knowledge is transitioning from dualism to multiplicity. According to Perry's theory students begin the shift from receiving knowledge from authority to learning differing perspectives and opinions.

PBL student-achievement goal 2: develop effective problem-solving skills. Autonomy toward interdependence is how Chickering defines this pattern of

development. Students begin to learn problem-solving skills and develop independence as a learner (Evans et al., 2010). The environmental factors affecting this PBL goal include curriculum design and teaching as defined by Chickering (Evans et al., 2010). Effective problem-solving skills are developed through the tutoring phase of PBL and the central curricular design for implementation (Barrows and Kelson, 1995). Perry identifies this position of development as multiplicity. Learners are engaged in learning through the realization and acceptance of relativism and opinions matter within the context of solving problems. There may be no right or wrong answer solving the problem since the focus of thinking has changed within the learner (Evans et al., 2010).

PBL student-achievement goal 3: develop self-directed, lifelong learning skills. Learners experience changing of knowledge and identify a need for personal commitment to learning to develop a desire for life-long learning (Evans et. al, 2010). Again, autonomy towards interdependence is developed based on Chickering's theory additionally the developing purpose vector begins to transform the learner. Developing purpose allows the learner to set clear goals for learning, develop commitment, and increases intentional decision-making (Evans et al., 2010). Perry's theory offers a continuum from multiplicity towards relativism and foreseen commitment as seen in position five and six.

PBL student-achievement goal 4: become effective collaborators.

Chickering's vector of developing mature interpersonal relationships and developing integrity are closely related to becoming an effective collaborator. Through the effective collaboration, learners develop an appreciation of differences and humanize values of

individuals. Development in these two vectors allows the learner to create a balanced interest between personal views and the opinions of other learners. Perry's position seven, initial commitment, correlates with collaboration. The initial commitment by the learner allows for the development of diversity in knowledge and is primarily based on individual learning (Evans et al., 2010). The understanding of knowledge as diverse relates back to the initial stages of multiplicity in position four where the learner recognizes opinions and the ability to develop arguments based on knowledge (Evans et al., 2010).

PBL student-achievement goal 5: become intrinsically motivated to learn. Developing a problem to achieve this goal requires the educator to understand the various stages of student development. Novice learners who have not transitioned from dualism to multiplicity in Perry's theory will have difficulty meeting this goal of PBL because they still learning as being externally motivated by grades or authority. Learners should have developed to position five, relativism correlate, where Perry identifies intrinsic motivations primarily occurs. While each learner may not have reached, position five student development will continue as the learner gains experience within the PBL model. Perry's positions, seven through nine, lead to commitment where the learner commits to learning and growth. Perry believed this primarily took place as the learner entered the upper levels of college work and continued throughout the professional career. Chickering's theory identifies the vectors of autonomy towards interdependence, developing purpose, and developing integrity as areas of development impacted by the goal of intrinsic motivation to learn. One of the key factors for

interdependence is problem-solving and development of independent learning. Intrinsic motivation also outlines clear goals and developing a purpose for learning while developing an overall sense of responsibility of gaining new knowledge (Evans et al., 2010).

Implications for the BOC, Inc. Treatment & Rehabilitation Domain

The Treatment and Rehabilitation (TR) domain is one of the five practice domains for athletic training and comprises 22% of the national certification examination as identified in the BOC, Inc. Role Delineation Study/Practice Analysis, 6th Edition (BOC, Inc. 2010). Each of the five practice domains is further classified into specific domain tasks, with statements of knowledge and skills. The TR domain consists of six standard tasks (Table 3) these standard tasks, incorporate the NATA Competencies 5th Edition (Table 2) in the overall introduction, practice, and mastery of the standards. The overarching goal of the treatment/rehabilitation plans developed by the Certified Athletic Trainer is to return the patient to normal optimal levels of activities. This is achieved by providing a comprehensive patient-centered plan.

The implications PBL has on the treatment/rehabilitation domain can transform the AT student's commitment to learning, changing how students approach the treatment/rehabilitation management of patients. Through the integration of PBL and the necessity for evidence-based practice within the TR domain, AT students have the opportunity to be exposed to decision-making practices long before entering professional practice. This integration should be performed throughout the student's tenure.

Implications for Professional Educators (Multidisciplinary)

While the results of this study were inconclusive, there are implications for this research that affect educators across many fields, specifically professional preparation programs, such teacher education and other allied health programs. The simple fact is that a theory to practice gap exists and it affects all educators. How educators choose to deal with the theory application gap is a curriculum and instruction decision.

Baxter (2007) noted nursing students face two areas of concern when dealing with the theory application gap. First, nursing students face the problem of a "reality shock" when placed in a clinical setting where theory learned in a class does not have real-world applications. Second, the application of evidence-based practice is less likely to occur in the clinical education setting if the professional clinician responsible for supervising the student is not practicing evidence-based medicine (Baxter, 2007). The observations by Baxter can be identified throughout multidisciplinary educators. Students who do not receive the appropriate integration of professional practice standards will have a "reality shock" when placed in a clinical and/or practical experience.

The thematic deficiencies, noted by Carr (2011) revealed that, 3-5 years after graduation, students had several insufficiencies, including interpersonal communication, decision making/independence, initiative, confidence, and ability to learn from mistakes. The use of PBL can have a direct influence on whether the student is prepared for the realities of being a professional. This is achieved by creating problems that address specific areas of professional development, competencies, knowledge, and skills, as well as national standards for practice.

Baxter addresses one way of narrowing the theory application using CCARE (Communication, Collaboration, Application, Reflection, and Evaluation) model of clinical supervision (Baxter, 2007). The CCARE model to clinical supervision of nursing students provides the necessary lines of communication between clinical preceptors, educators, students, and patient. The focus is on quality patient care for all participants. Baxter describes this as a bridge to caring: care for the patient, care for the preceptor, care for the faculty member, care for the student and care for the profession. The bridge, proposed by Baxter ties the two cultures (academic and clinical) together (Figure 35).

While Baxter's example is directly related to nursing students, the process can be applied in the same manner for many disciplines; simply replace "Quality Patient Care" with the specific outcome the discipline requires. The foundational principal behind Baxter's case is the opportunity for both educators and students to focus on specific professional outcomes, which requires putting theory into practice. This merging of educational theory with applied practice aims to increase the quality of professional development with the specified discipline.

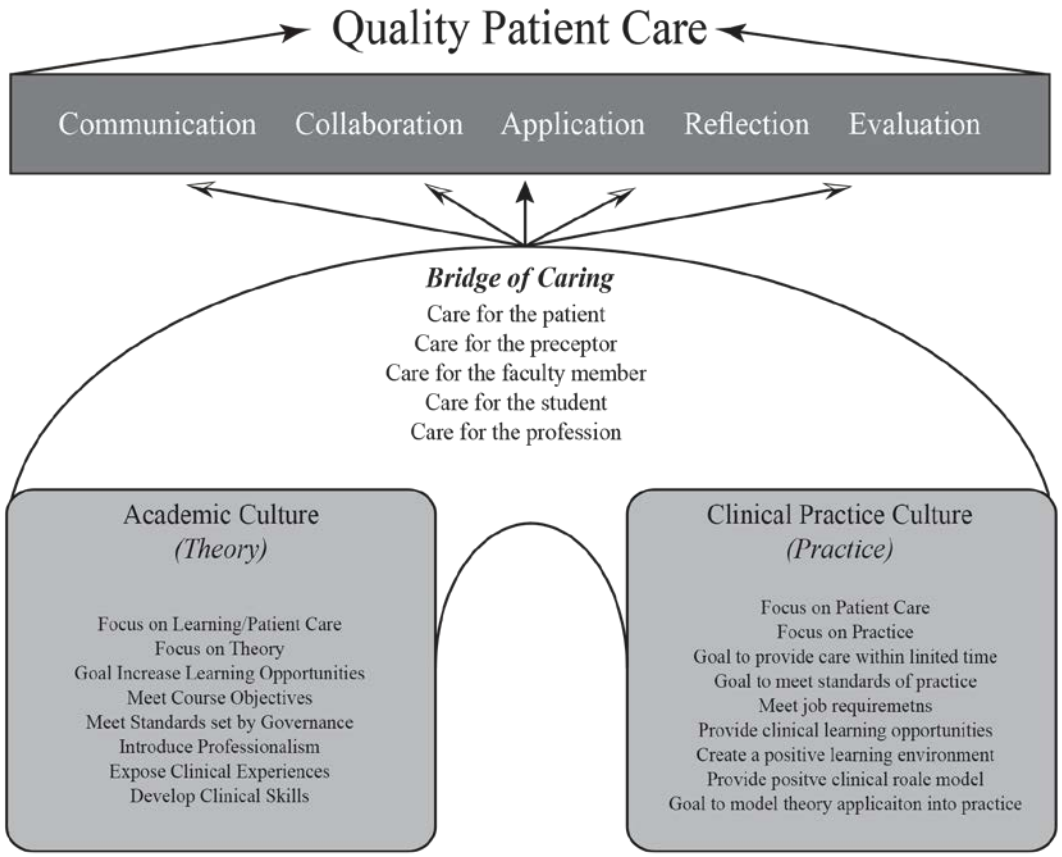


Figure 35 CCARE Model
(Baxter, P., 2007).

Future Research

The research conducted through this study looked specifically at the BOC, Inc. treatment and rehabilitation domain as the center of the problem sets for the academic levels. The rationale behind the selection of the treatment and rehabilitation domain was the fact that RU student scores in this domain were below the national average. . Therefore, this study was limited in the ability to study greater outcomes across the theory application gap.

In order to fully appreciate the effects PBL has on the theory application gap, further studies should be conducted to understand better the usefulness of this instructional strategy. The theory application gap exists when a breakdown in learning occurs in the classroom and clinical practice integration. PBL research in athletic training has been limited to specific course implementation and the effectiveness PBL has on developing critical thinking skills (McLoda, 1996; Catlaw, 1999; and Dochy et. al, 2003). Many options for further research emerged from the findings of this study. The researcher proposes future research studies focus on three objectives, (1) engaging athletic training educators in PBL implementation, (2) evaluating the theory application gap as it relates to clinical competence in ATE, and (3) the effects of PBL in narrowing the theory application gap through a longitudinal study.

This study was limited due to the short time frame of the research, as well as a small student population. A greater understanding of the effects of PBL will require a longer period of study, as well as qualified PBL facilitators. Research indicates a complex and difficult relationship between the classroom and clinical practice

(Waterman, Webb, & Williamson, 2005). This complexity is due to the theory application gap, which also creates complex relationships between cooperating didactic instruction and clinical instructors (Carr, 2002; Waterman, Webb, & Williamson, 2005). Therefore researching how athletic training educators engage in the practice of PBL can offer insight into the further development of the PBL instructional strategy in ATE. The researcher proposes additional research focusing on the collaboration between AT faculty and clinical instructors using PBL as a means to reduce the theory application gap (McDaniel and Colariulli, 1997).

As previously mentioned this study was conducted over a short five-week period consisting of nine (9) PBL interventions. The limited time frame for this study did not adequately address the central question; therefore, additional research on the effectiveness of PBL in narrowing the theory application should be completed. The researcher proposes developing a longitudinal study over the course of the academic life of three individual cohorts. Studying PBL in a longitudinal format may provide the necessary results to confirm or deny the effectiveness PBL has on narrowing the theory application gap. The rationale for suggesting a study of AT cohorts allows for the collection of data over a five-year period. After the conclusion of the five-year period, there can be a true comparison of national test scores to evaluate whether PBL enhanced the overall RU scores on the Board of Certification, Inc. national certification exam. In order for this study to be effective, PBL would need to be a core component within the ATE curriculum in order to determine the usefulness of this instructional strategy for narrowing the theory application gap over time.

Conclusions

This research study was conducted at RU in Texas and sought to determine: How does PBL reduce the theory application gap within the treatment and rehabilitation domain in an undergraduate athletic training education program. Throughout the review of focus groups and reflective journals, the study indicated how a PBL intervention could possibly reduce the theory application gap within the treatment and rehabilitation domains as well as the difficulties students have with PBL. Three conclusions can be drawn from this data of this convergent designed mixed methods study: (1) students perceive a gap between theory and application, (2) self-directed learning is barrier to narrowing the theory application gap**,** and (3) time is a key factor for PBL implementation.

Students Perceive a Gap between Theory and Application

Research in competency-based education programs points to a theory application gap between the didactic and clinical component (Baxter, 2007, Carson & Carnwell, 2007, Carr, 2002). This study explored whether students perceived there was a gap between what they learned in the classroom and what they applied in a real world clinical field experience.

While many studies suggest the theory application gap exists in allied health and medical education, no study could be found in ATE assessing how PBL addresses the theory application gap (Baxter, 2007, Carson & Carnwell, 2007, Carr, 2002, Lesperance, 2008, Gillette, 2011, McLoada, 1996). The findings of this study suggest students do perceive and experience a gap in learning and the transfer of knowledge between

didactic courses and clinical application. Furthermore students identified PBL, through qualitative analysis, as a suitable instructional strategy for decreasing the theory application gap; however the quantitative results of the EMCR PBL self-assessment do not support the student perceptions within the self-directed learning objective. The conclusion of the students indicating the existence of the theory application gap is supported by the research conducted by Baxter, (2007), Carson & Carnwell, (2007), and Carr, (2002).

Self-Directed Learning Is a Barrier to Narrowing the Theory Application Gap

The PBL objective of self-directed learning is essential and critical to the development of problem-solving skills (Barrows, 1994 & 1995, Amador, Miles, and Peters (2006). Within this research, students from all academic levels scored "Poor" within the EMCR scoring criteria. This particular PBL objective lends itself to the development of all the additional PBL objectives and promotes connecting the content with the application (Amador, Miles, & Peters, 2006). The self-directed learning objective was the only objective to receive "Poor" classification.

Students are participating in the study openly admitted they did not pursue self-directed learning outside of the PBL intervention. Once the PBL intervention session was completed, students did not revisit the problem scenario or elect to do independent research to enhance the problem solution. This evidence is concerning because self-directed learning is a critical component in the development of the application of knowledge, collaborative learning, and clinical reasoning (Amador, Miles, & Peters, 2006). Through the implementation of a problem, the learner participates in developing

an effective clinical reasoning process, self-directed learning skills, and increased motivation for learning, which engages the learner in problem-solving, critical thinking, discovery learning, and increased awareness of experiences (Barrows, 1994 & 1995). Within this study, the poor performance of the PBL objective of self-directed learning was attributed to the amount of time students were willing to set aside for personal growth.

Time is a Key Factor for PBL Implementation

The greatest barrier to effective PBL implementation is time. Students identified time as the single most important factor in their engagement with PBL. Time was most frequented cited as a negative aspect of a PBL intervention. Students within each level reflected on the amount of time it takes to engage in PBL. This is substantiated by additional research in PBL performed by McLoada, (1996), Lesperance, (2008), and Gillette, (2011).

Students offered alternatives for PBL implementation such as the integration of "labs" for ATE curriculum courses. Additionally students believe the time of day played a factor in their engagement practice within the PBL intervention. Students were unable to provide ample solutions to the time dilemma for the PBL intervention. One student even shared that since this was a study, she did not feel the need to over-commit herself.

REFERENCES

Abraham,R., Upadhya, S., & Ramnarayan, K. (2005). Self-directed learning. *Advances in Physiology Education. 29*(2), 135-136.

Albanses, M. & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. *Academic Medicine. 68*(1), 52-81.

Alfieri, L. (2010). *Does discovery-based instruction enhance learning?* (Doctoral dissertation). Retrieved from ProQuest database. (UMI No. 3408485).

Allen, J. & Wright, S. (2013). Integrating theory and practice in the pre-service teacher education program. *Teachers and Teaching: Theory and Practice. 20*(2), 136-151.

Amador, J. A., Miles, L., & Peters, C. B. *The practice of problem-based learning: a guide to implementing PBL in the college classroom*. Bolton, Mass.: Anker, 2006.

Amato, H., Konin, J. & Brader, H. (2002). A model for learning over time: The big Picture. *Journal of Athletic Training.37* (4), s-236-s-240.

Anderson, W., Mitchell, S. & Osgood, M. (2008). Gauging the gaps in student problem-solving skills: Assessment of individual and group us of problem-solving strategies using online discussions. *CBE Life Science Education. 7*(2), 254-262.

Angell, B. & Townsend, L. (2011). *Designing and conducting mixed methods studies.* [PowerPoint slides]. Retrieved from http://docslide.us/documents/designing-and-conducting-mixed-methods-studies.html.

Baptiste, S. (2003). *Problem-based learning: A self-directed journey.* Thorofare, NJ: Slack.

Barrows, H.S. (1994). *Practice-based learning: Problem-based learning applied to medical education.* Springfield, IL: Southern Illinois University School of Medicine.

Barrows, H. (1995). *Practice-based learning: Problem-based learning applied to medical education.* : Springfield, IL: Southern Illinois University School of Medicine.

Barrows, H. (1988). *The tutorial process* (Rev. Ed.). Springfield, IL: Southern Illinois University School of Medicine:

Barrows, H. & Pickell, G. (1991). *Developing clinical problem-solving skills.* Norton Medical Books: New York, NY.

Barrows, H. & Tamblyn, R. (1980). *Problem-based learning: An approach to medical education.* New York: Springer.

Baxter, P. (2007). The CCARE model of clinical supervision: Bridging the theory practice gap. *Nurse Education in Practice 7*, 103-111

Becheikh, N., Ziam, S., Idrissi, O., Castonguay, Y., & Landry, R. (2010). How to improve knowledge transfer strategies and practices in education? Answers from a systematic literature review. *Research in Higher Education. 1*, 1-21.

Belland, B., French, B, & Ertmer, P. (2009). Validity and problem-based learning research: A review of instruments used to assess intended learning outcomes. *Interdisciplinary Journal of Problem-Based Learning. 3*(1), 3-24.

Berry, D. (2010). How well do we know how to teach? *Athletic Training Education Journal. 5*(1), 38-39.

Bransford, J.D., Brown, A.L., & Cocking, R.R. (Eds.). (2000*). How people learn: Brain, mind, experience, and school.* Washington, D.C.: National Academy Press.

Board of Certification, Inc. (2010). *The 2009 athletic trainer role delineation study.* Omaha, NE: Stephen B. Johnson.

Capraro, R. & Slough, S. (Eds.). (2009). *Project-based learning: An integrated science, technology, engineering, and mathematics (STEM) approach.* Rotterdam, The Netherlands: Sense Publishers.

Carr, D. (2012). Employer and employee opinions of thematic deficiencies in new athletic training graduates. *Athletic Training Education Journal. 7*(2), 53-59.

Carr, W. David., Drummond, & Jan L. (2002). Collaboration between athletic training clinical and classroom instructors. *Journal of Athletic Training 37*(4), S-182-S-188.

Carlson, H. (2010). From practice to theory: A social constructivist approach to teacher education. *Teachers and Teaching: Theory and Practice*. *5*(2), 203-218.

Carson, A. & Carnwell, R. (2007). Working in the theory-practice gap: The Lecture practitioner's story. *Learning in Health and Social Care. 6*(4), 220-230.

Catlaw, K. (1999). *Problem-based learning in athletic training education* (Doctoral dissertation). Available from ProQuest database. (UMI No. 9943994)

Checkland, P. & Holwell, S.E. (1998). Action research: its nature and validity. *Systemic Practice and Action Research. 11*(1), 9-21.

Clark, R. & Harrelson, G.L. (2002). Designing instruction that supports cognitive learning processes. *Journal of Athletic Training. 37*(4), S-152-159.

Chiou-Fen, L., Meei-Shiow, L., Chun-Chih, C., & Che-Ming, Y. (2010). A comparison of problem-based learning and conventional teaching in ethics education. *Nursing Ethics*. *17*(3), 373-382.

Cooke, M., Irby, D.M., Sullivan, W., & Ludmerer, K. M. (2006). American medical education 100 years after the Flexner report. *New England Journal of Medicine, 355,* 1339-44.

Committee on accreditation of athletic training education programs. (2012) *Standards for Accreditation of Professional Athletic Training Programs,* 2012. [PDF document] http://caate.net/wp-content/uploads/2014/07/2012-Professional-Standards.pdf.

Creswell, J.W., Klassen, A.C., Plano-Clark, V.L., & Smith, K.C. (2011). Best practices for mixed methods research in health sciences. Commissioned by the Office of Behavioral and Social Sciences Research, US Department of Health & Human Services. Retrieved from: http://obssr.od.nih.gov/scientific_areas/methodology/mixed_methods_research/section6.aspx

Creswell, J.W., & Plano-Clark, V.L., (2007). *Designing and conducting mixed-methods research*. Thousand Oaks, CA: Sage Publishing.

Desforges, C. & Lings, P. (1998). Teaching knowledge application: Advances in theoretical conceptions and their professional implications. *British Journal of Educational Studies. 46*(4), 386-389.

DeGrave, W. S., Dolmans, D. H. J. M., & Van Der Vleuten, C. P. M. (1999). Profiles of effective tutors in problem-based learning: Scaffolding student learning. *Medical Education 33*, 901-906.

De Grez, L., Valcke, M., & Roozen, I. (2012). How effective are self- and peer assessment of oral presentation skills compared to teachers' assessments? *Active Learning in Higher Education 13*(2), 129-142.

Dewey, J. (1983 [1938]). *Experience & experience.* New York: Touchstone.

Dey, I. (1993). *Qualitative data analysis: A user friendly guide for social scientist.* London: Routledge.

Dochy, F., Segers, M., Van den Bossche, P., & Gijbels, D. (2003). Effects of problem-based learning: a meta-analysis. Learning and instruction: *The journal of the European Association for Research on Learning and Instruction*, *13*(5), 533-568

Dodge, T., Mitchell, M. & Mensch, J. (2009). Student retention in athletic training education programs. *Journal of Athletic Training. 44*(2), 197-207.

Dolmans, D. & Gijbels D. (2013). Research on problem-based learning: Future challenges. *Medical Education. 47*, 214-218.

Duffy, T.M. & Jonassen, D. (Eds.), (1992). *Constructivism and the technology of instruction: A conversation*. Hillsdale, NJ: Lawrence Erlbaum Associates

Duffy, K. & Watson, H. (2001). An interpretive study of the nurse teachers' role in

practice placement areas. *Nurse Education Today. 21*, 555-558.

Elizond-Montemayor, L. (2004). Formative and summative assessment of the problem-based learning tutorial session using a criterion-referenced system. *International Association of Medical Science Educators*. *14*, 8-14.

Evans, N., Forney, D., Guido, F., Patton, L., & Renn, K. (2010). *Student Development in College: Theory, Research, and Practice.* San Francisco, CA. Jossey-Bass.

Farnsworth, C. (1996). *Tracking the development of clinical expertise in veterinary students: Measuring the effects of problem-based learning.* (Doctoral dissertation). Available from ProQuest database. (UMI No. 9701621)

Forthofer, M.S. (2003). *Status of mixed methods in the health sciences*. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social & behavioural research* (pp. 527-540). London: Sage

Gallagher, S. & Gallagher, J. (2013). Using problem-based learning to explore unseen academic potential. *Interdisciplinary Journal of Problem-based Learning. 7*(1), 3-15.

Geisler, P. & Lazenby, T. (2009). Clinical reasoning in athletic training education: Modeling expert thinking. *Athletic Training Education Journal. 4*(2), 52-65.

German, N. (2008). *Assessment of critical thinking skills among undergraduate athletic training students.* (Doctoral dissertation). Available from ProQuest database. (UMI No. 3335160).

Gibbs, A. (1997). Focus groups. *Social Research Update*. Winter 1997. Retrieved from http://sru.soc.surrey.ac.uk/SRU19.html.

Gijbels, D., Dochy, F., Van den Bossche, P. & Segers, M. (2005). Effects of problem-based learning: A meta-analysis from the angle of assessment. *Review of Educational Research. 75*(1), 27-61.

Gillette, C. (2011). *Preparing proficient practitioners: Problem-based learning in athletic training education.* (Doctoral dissertation). Available from ProQuest database. (UMI No. 3449703)

Hemlo-Silver, C., (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review. 16*(3), 235-266.

Heinrichs, K. (2002). Problem-based learning in entry-level athletic training professional-education programs: A model for developing critical-thinking and decision-making skills. *Journal of Athletic Training. 37*(4), S-189-S-198.

Hendry, G., Frommer, M. & Walker, R. (1999). Constructivism and problem-based learning. *Journal of Further and Higher Education. 23*(3), 369-371.

Hendry, G., Lyon, P., Prosser, M., & Sze, D. (2006). Conceptions of problem-based learning: The perspectives of students entering a problem-based medical program. *Medical Teacher. 28*(6), 573-575.

Hood, A. B., & Deopere, D.L. (2002). The relationship of cognitive development to age, when education and intelligence are controlled for. *Journal of Adult Development, 9*(3), 229-234.

Hoon, T. C. & M. C. Gwee (2003); Student Assessment in Problem- Based Learning: A challenge Beyond Reliability & Validity; Assessment, *Centre for Development of Teaching and Learning 6* (3), 4-6.

Houglum, P. & Weidner, T. (2001). Terminology: a rose is a rose, but according to whom? *NATA News*. 40-41.

Howell, K. W. & Nolet, V. (2000). Tools for assessment. In *Curriculum-Based Evaluation, Teaching and Decision Making. 3rd Ed*. Scarborough, Ontario: Wadsworth/Thompson Learning.

Hughes, C., Steinhorn, R., Davis, B., Beckrest, S., Boyd, E., & Cashen, K. (2012). University-based service learning: Relating mentoring experiences to issues of poverty. *Journal of College Student Development. 53*(6), 767-782.

Hunt, J., Bonham, C., & Jones, L. (2011). Understanding the goals of service learning and community-based medical education: A systematic review. *Academic Medicine. 86*(2), 246-251.

Indiana university school of dentistry. (2009). *Student handbook for problem-based, student-centered learning at IUSD.* Indianapolis, IN: Indian University-Purdue University Indianapolis.

Joyce, B. &Weil, M. (1996). *Models of Teaching* (5th Ed). Englewood Cliffs, NH: Prentice Hall.

Joyce, B., Weil, M., & Calhoun, E. (2009) *Models of Teaching.* Boston: Pearson education.

Kaufman, D. (2003). Applying educational theory in practice. *British Medical Journal. 326*(7382), 213-216.

Kemp, S. (n.d.) *Constructivism and Problem Based Learning: Learning Academy* [PDF document]. Retrieved from:

http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CEcQFjAC&url=http%3A%2F%2Fwww.tp.edu.sg%2Ffiles%2Fcentres%2Fpbl%2Fpbl_sandra_joy_kemp.pdf&ei=inTqUvOZH6G2yAHq9YGgCQ&usg=AFQjCNF3c6klJQdZQape3IcJPag9bK3Scw&sig2=3ScoiQXvXmcYXWZLyCoDwQ&bvm=bv.60444564,d.aWc

Knight, K. L. (2006). Educational perceptions vs. reality; Classroom and clinical education. *Athletic Training Education Journal 1*(1), 15-17.

Langendyk, V. (2006). Not knowing that they do not know: self-assessment accuracy of third-year medical students. *Medical Education*. *40*, 173-179.

Larocheel, M., Bednarz, N. & Garrison, J. (1998). *Constructivism and education.* Cambridge, New York: Cambridge University Press.

Laurent, T., & Bradney, D. (2007). Leadership behaviors of athletic training leaders compared with leaders in other fields. *Journal of Athletic Training. 42*(1), 120-125.

Laurent, T., & Weidner, T. G. (2001). Clinical instructors' and student athletic trainers' perceptions of helpful clinical instructor characteristics. *Journal of Athletic Training, 36*(1), 58-61.

Leaver-Dunn, D., Harrelson, G.L., Martin, M., & Wyatt, T. (2002). Critical-thinking predisposition among undergraduate athletic training students. *Journal of Athletic Training.* 37(4), S-147-S-151.

Lesperance, M. (2008). *The effects of problem-based learning (PBL) on students' critical thinking skills.* (Doctoral dissertation). Available from ProQuest

database. (UMI No. 3337475).

Levin, R. (2010). Integrating evidence-based practice with education theory in clinical practice for nurse practitioners: Bridging the theory practice gap. *Research and Theory for Nursing Practice. 24*(4), 213-216.

Litoselliti, L. (2003). *Using focus groups in research.* New York: Continuum. 104p.

Lohman, M.C., & Finkelstein, M. (2000). Designing groups in problem-based learning to promote problem-solving skill and self-directedness. *Instructional Science. 28*, 291-307.

Ludmerer, K. M. (2010). Understanding the Flexner report. *Academic Medicine 85(2),* 193-196.

Maarof, N. (2007). Telling his or her story through reflective journals. *International Education Journal*. *8*(1), 205-220.

Macdonald, R. (2005). *Assessment strategies for enquiry and problem-based learning*. In. Barrett, T., Labhrainn, I., and Fallon, H. (Eds). *Handbook of enquiry & problem-based learning*, 85-93. Galway, Ireland.

Macdonald, R., & Savin-Baden, M. (2004) *A briefing on assessment in problem-based learning.* Heslington,York: LTSN Generic Centre Assessment Series. Learning and Teaching Support Network.

Maker, C.J. & Shiver, S.W. (2005). *Teaching models in education of the gifted.* Austin, TX: Pro.Ed.

Maben, J., Latter, S., & Clark, J. (2006). The theory-practice gap: Impact of professional bureaucratic work conflict on newly-qualified nurses. *Journal of Advanced Nursing. 55*(4), 465-477.

Major, C., & Palmer, B., (2001). Assessing the effectiveness of problem-based learning in higher education: Lessons from the literature. *Academic Exchange Quarterly* 2001. *5*, 1-6.

Marshall, C. & Rossman, G. (2006). *Designing Qualitative Research.* Thousand Oaks, CA. Sage.

Marra, R. & Bogue, B. *A critical survey on online assessment tools. In proceedings of proceedings of the 2006 WEPAN Conference*. Pittsburg, PA: WEPAN-Women in Engineering Programs and Advocates Network, June 10-13, 2006. (Available at www.wepan.org)

Mazerolle, S., Bowman, T., & Bens, S. (2014). Defining the engaging learning experience from athletic training student perspective. *Athletic Training Education Journal. 9*(4), 182-189.

Mensch, J. & Ennis, C. (2002). Pedagogic strategies perceived to enhance student learning in athletic training education. *Journal of Athletic Training*. *37*(4), S-199-S-207.

McDaniel, E. & Colarulli, G. (1997). Collaborative teaching in the face of productivity concerns: The dispersed team model. *Innovative Higher Education. 22*, 19-36.

McDonald, B. & Boud, D. (2003). The impact of self-assessment on achievement: The effects of self-assessment training on performance in external examinations.

Assessment in Education: Principles, Policy & Practice. 10(2), 209-220.

McGee, M. (2003). *A comparison of traditional learning and problem-based learning in pharmacology education for athletic training students* (Doctoral dissertation). Available from ProQuest database. (UMI No. 3113338)

McLoda, T. (1996). *The application of problem-based learning to athletic training education* (Doctoral Dissertation). Available from ProQuest database. (UMI No.9639699)

Mitchell, M., Strube, P., Vaux, A., West, N., & Auditore, A. (2013). Right person, right skills, right job: the contribution of the objective structured clinical examinations in advancing staff nurse experts. *The Journal of Nursing Administration. 43*(10), 543-548.

Morgan, D. (1997). *Focus Groups as Qualitative Research.* Thousand Oaks, California: Sage.

National athletic trainers' association (2011). Athletic training education competencies, 5th ed. Retrieved from http://www.nata.org/education/competencies.

Nasypany, A. (2005). *Survey of athletic training clinical education: Perceptions from the field.* (Doctoral Dissertation). Available from ProQuest database. (UMI No. 3191244).

Nendaz, M. & Tekian, A. (2009). Assessment in problem-based learning medical schools: A literature review. *Teaching and Learning in Medicine: An International Journal. 11*(4), 232-243.

Norman, G. R., & Schmidt, H. G. (1992). The psychological basis of problem-based learning: A review of the evidence. *Academic Medicine*, *67*(9), 557–565.

O'Connor, E. Mahvi, D., Foley, E., Lund, D., & McDonald, R. (2010). Developing a practice-based learning and improvement curriculum for an academic general surgery residency. *Journal of American College of Surgery*. *210*(4), 411-417.

Ostlund, U., Kidd, L., Wengstrom, Y., & Rowa-Dewar, N. (2011). Combining qualitative and quantitative research within mixed method research designs: A methodological review. *International Journal of Nursing Studies 48,* 369-383.

Oxford, R. (1997). Constructivism: Shape-shifting, substance, and teacher education applications. *Peabody Journal of Education*, *72*(1), 35–66.

Ozogul, G. & Sullivan, H. (2009). Student performance and attitudes under formative evaluation by teacher, self, and peer evaluators. *Educational Technology Research and Development. 57*(3), 393-410.

Palmer, B., Marra, R. M., Wise, J. C., & Litzinger, A. (2000). *A longitudinal study of intellectual development of engineering students: What really counts in our curriculum?* In D. Budny & Bjedov, B. (Eds) 30th ASEE/IEEE Frontiers in Education Conference (FIE) 2000. Kansas City, MO, S3A2 thru S3A6.

Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects student (Vol. 2): A third decade of research*. San Francisco: Jossey-Bass

Perera, J., Mohamadou, G., & Kaur, S. (2010). The use of objective structured self-assessment and peer-feedback (OSSP) for learning communication skills:

Evaluation using a controlled trial. *Advances in Health Sciences Education, 15*, 185–193.

Perrin, D. H. (2007). Athletic training: From physical education to allied health. *Quest 59,* 111-123.

Pitney, W. & Ehlers, G. (2004). A grounded theory study of the mentoring process involved with undergraduate athletic training students. *Journal of Athletic Training*. *39*(4), 344-351.

Pitney W, Ilsley P, & Rintala J. (2002). The professional socialization of certified athletic trainers in the National Collegiate Athletic Association Division I. *Journal of Athletic Training. 37,* 63–70.

Pitney, W. & Parker, J. (2002). Qualitative research applications in athletic training. *Journal of Athletic Training. 37*(4), S-168-S-173.

Price, J. (2008). *Identification of core goals and related outcome measurements for the development of community service learning programs in selected institutions of higher education.* (Doctoral dissertation.) Available from ProQuest database. (UMI No. 334001).

Piaget, J. (1973). *To understand is to Invent: The Future of Education*. New York: Grossman Publisher

Plano-Clark, V. L. (2010). The adoption and practice of mixed methods: U.S. trends in federally funded health-related research. *Qualitative Inquiry, 6*(6), 428-440.

Potteiger, K., Brown, C., & Kahanov, L. (2012). Altering the athletic training curriculum: A unique perspective on learning over time. *Athletic Training*

Education Journal. *7*(2),60-69.

Powell R.A., Single H.M., & Lloyd K.R. (1996) Focus groups in mental health research: enhancing the validity of user and provider questionnaires', *International Journal of Social Psychology 42* (3), 193-206.

Radtke, S. (2008). A conceptual framework for clinical education in athletic training. *Athletic Training Education Journal. 3*(2), 36-42.

Rangachari, P. K. (2002) The TRIPSE: A process-oriented evaluation for problem-based learning courses in basic sciences, *Biochemistry and Molecular Biology Education, 30* (1), 57-60.

Rauscher, L & Greenfield, BH. (2009). Advancements in contemporary physical therapy research: Use of mixed methods designs. *Physical Therapy. 89*(1), 91-100.

Ryan, R., Murray, D., & Martin, M. (2009). The use of discovery learning in athletic training education. *Athletic Therapy Today. 14*(4), 32-35.

Saldana, J. (2011). *Fundamentals of qualitative Research: understanding qualitative research.* New York: Oxford University Press

Saldana, J. (2013). *The coding manual for qualitative researchers.* Thousand Oaks, CA: Sage.

Saunders-Stewart, K., Gyles, P., & Shore, B. (2012). Student outcomes in inquiry instruction: A literature derived inventory. *Journal of Advanced Academics. 23*(1), 5-31.

Savin-Baden, M. (2000). *Problem-based learning in higher education: Untold stories.* Philadelphia, PA: SRHE & Open University Press.

Schmidt, H.G., Rotgans, J., & Yew, E. (2011). The process of problem-based learning: What works and why. *Medical Education. 45*, 792-806.

Sexton, P. (2003). A perspective on student assessment. *Athletic Therapy Today. 8*(6), 6-10.

Sexton, P. (2011). Fostering supervised autonomy in athletic training students. *The Eight Athletic Training Educators' Conference: Course Handout.* Washington D.C. (Available from www.nata.org)

Sexton, P., Levy, L., Willeford, S., Sean, K., Barnum, M., Gardner, G., Guyer, M., & Fincher, A. (2009). Supervised Autonomy. *Athletic Training Education Journal. 4*(1), 14-18.

Singer, F. & Moscovici, H. (2008). Teaching and learning cycles in a constructivist approach to instruction. *Teaching and Teacher Education*. *24*, 1613-1634.

Smith-Goodwin, E. & Wimer, J. (2010). Using problem-based learning to link classroom and clinical education. *Athletic Therapy Today. 15*(1), 23-27.

Somekh, B. (2006). *Action Research: A methodology for change and development.* New York : McGraw-Hill.

Streveler, M. (2013). *Students' perception of a theory-practice gap in athletic training education.* (Doctoral dissertation). Available from ProQuest database. (UMI No. 3560599).

Tilley, D. S., Allen, P., Collins, C, Bridges, R. A., Francis, P., & Green, A. (2007). *Journal of Professional Nursing, 23*(5), 285-289.

Turocy, P. (2002). Overview of athletic training education research publications. *Journal of Athletic Training. 37*(4), s-162-s-167.

Walker, A. & Leary, H. (2009). A problem-based learning meta-analysis: Differences across problem types, implementation types, disciplines, and assessment levels. *The Interdisciplinary Journal of Problem-based Learning. 3*(1), 12-43.

Walker, S. (2005). Encouraging the disposition to critically think. *Athletic Therapy Today. 10*(2), 42-44.

Walker, S. (2006). Journal writing as a teaching technique to promote reflection. *Journal of Athletic Training*. *41*(2), 216-221.

Walker, S. Weidner, T. & Armstrong, K. (2008). Evaluation of athletic training students' clinical proficiencies. *Journal of Athletic Training. 43*(4), 386-395.

Walker, SE. (2012). *Developing critical thinking skills in athletic training students.* Webinar presented online by the National Athletic Trainers' Association, April 11, 2012. (Available from http://members.nata.org/quizcenter/register.cfm)

Walker, S. & Weidner, T. (2010). Standardized patients provide realistic and worthwhile experiences for athletic training students. *Athletic Training Education Journal. 5*(2), 77-86.

Walker, S. & Weidner, T. (2010). The use of standardized patients in athletic training education. *Athletic Training Education Journal. 5*(2), 87-89.

Waterman, H., Webb, C., & Williams, A. (1995). Changing nursing and nursing change: dialectical analysis of an action research project. *Journal of Advanced Nursing. 3*(1), 55-70.

Weidner, T. G., & Henning, J. (2002). Historical perspective of athletic training clinical education. *Journal of Athletic Training. 37*(4), S-222-S-228.

Weidner, T. G., Nobel, G. L., & Pipkin, J. B. (2006). Athletic training students in the college/university setting and the scope of clinical education. *Journal of Athletic Training, 41*(4), 422-426.

Weidner, T. G. & Popp, J. K. (2007). Peer-assisted learning and orthopedic evaluation psychomotor skills. *Journal of Athletic Training, 42*(1), 113-119.

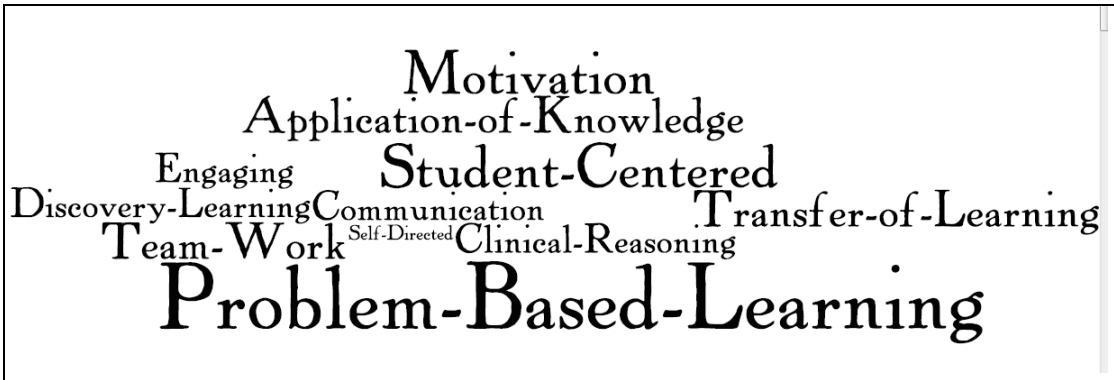
Yang, C. (2012). Cultivating critical thinkers: Exploring transfer of learning from pre-service teacher training to classroom practice. *Teacher and Teacher Education. 28,* 1116-1130.

Zayyan, M. (2011). Objective structured clinical examination: The assessment of choice. *Oman Medical Journal. 26*(4), 219-222.

Zimmerman, B. (2002). Becoming a self-regulated learner: An overview. *Theory Practice*. *41*, 64-70.

APPENDIX A

INVITATION FOR PARTICIPATION FLYER



Do you want to gain an ***EDGE?***
Do you like working with a ***Team?***
Do you like to ***Discover New Things?***

If you answered YES to any of these questions, then Problem-Based Learning may help you achieve your academic goals!

PBL is a student-center instructional strategy engaging students to take control of their learning.
PBL can enhance:
Critical Thinking Skills
Problem-Solving Skills
Clinical Reasoning
Communication
Teamwork
and
Bridge the gap between Knowing and Doing!

If you are interested in being a part of an exciting study in Problem-Based Learning, contact Mr. DJ Gililland at 325-829-3017 or via e-mail at djgatc@tamu.edu
This study is approved by the
Texas A&M University and Hardin-Simmons University
Institutional Review Boards

APPENDIX B

FOCUS GROUP PROTOCOL

General Format – Focus Group Protocol	
Date of Focus Group	
Facilitator	Darrell J. Gililland Jr.
Focus Group Participants (Use Initials)	
Explanation of who I am	Explained to interviewee? Yes ____ My name is DJ Gililland; I am the Head Athletic Trainer at Hardin-Simmons University and Lecturer of Fitness and Sport Sciences. I currently serve as an Approved Clinical Instructor of Athletic Training in the CAATE accredited ATEP. Currently I am pursuing a Doctorate in Education from Texas A&M University and I completing the Record of Study requirement for this degree. The title of the Record of Study is "*The Effects of Problem-Based Learning as a Tutoring Intervention in Athletic Training Education: Narrowing the Theory Application Gap in the Board of Certification, Inc. Treatment and Reconditioning Domain at a Regional University in Texas."*
Relevant responses from interviewee?	
Purpose of Focus Group	Explained to Focus Group? ☐Yes___ The purpose of this focus group is to dialogue with students regarding their understanding of problem-based learning and the theory application gap.
Right to refuse answering any questionS	Explained to Focus Group? Yes ____ The questions in this focus group are designed to assist the researcher to explore the questions proposed within this study. You need to know that you may refuse to answer any question in during the focus group for any purpose, without having to reveal to me your reasons for not answering the question. Do you understand that agreeing to participate in the focus group does not mean that you must answer all questions? Indicate the participants' response in this space Participant's response ____ Yes ____ No Participant's response ____ Yes ____ No Participant's response ____ Yes ____ No Participant's response ____ Yes ____ No Participant's response ____ Yes ____ No
Anonymity explained	Explained to Focus Group? Yes _____ This research focus group is being conducted under strict privacy standards. At no time will your name be used in the results of the study.

Formal agreement to participate	Do you agree to participate in an interview about my proposed field-based study? Participant's response ____ Yes ____ No Participant's response ____ Yes ____ No Participant's response ____ Yes ____ No Participant's response ____ Yes ____ No Participant's response ____ Yes ____ No
Explain your basic plan of the study	This mixed-methods study seeks to answer the central question: How does a tutoring intervention in PBL narrow the theory application gap within the BOC, Inc. treatment and rehabilitation domain in an undergraduate athletic training education program at Regional University in Texas? Additional questions include: ✓ Q1: Does PBL provide RU students in the ATE program knowledge and skills necessary to apply theoretical knowledge into practical application? ✓ Q2: How does PBL in the ATE program change the engagement practices of RU students within a formal tutoring intervention? ✓ Q3: What are the RU student's perceptions of PBL as a tutoring intervention for narrowing the theory application gap in the ATE program?
Are there parts of the plan that you would like me to explain further?	Write participants' responses here

Focus Group Questions	
In your experience, what problems have you experienced in bridging the gap between the classroom and clinical education model?	
Have you experienced problems in student comprehension with transfer of learning from the text to practical application?	
What about problems in developing problem based scenarios? Do you utilize this method of instruction?	
Have you ever attempted solutions to one of these problems? What were/was your solutions and how did they/it work?	
Fill in other questions in spaces below	
Other question(s)?	
Thank you so much for your time. Your answers have given me a lot to think about in the design of my study.	

APPENDIX C

PBL IMPLENTATION PROTCOL

PBL Implementation Protocol

Tutoring Session:
90 Minutes
Introduction of the Problem/PBL Pre-Self-Assessment:
10 Minutes
Instructional Period:
20 Min (Tutor provides supporting information within the TR domain)
Inquiry/Discovery Period:
30 Minutes (Students determine the following items while working in their groups: What do they know about the problem, What information is given about the problem, and What new knowledge must be learned to solve the problem)
Rebuttal Questioning Period:
30 Minutes (Students will be provided the opportunity to question the tutor probing for additional information before independent work commences during the week)
Independent & Group Work Period:
Over the ensuing week, students will work independently researching possible solutions to the problem. The group will meet a minimum of two times to discuss individual findings and communicate with the group possible solutions to the problem.
Reflective Journaling Period:
Students will be asked to complete a reflective journaling entry regarding their experience with PBL. These entries will be collected via WuFoo Form Builder© during the course of weeks two, four, and six.

PBL Solutions Session

Tutoring Session:
60-90 Minutes
Solution of the PBL/Post-Self-Assessment:
30 Minutes (Group will complete a PBL Post-Self-Assessment and then present their solution to the PBL exercise.
Focus Group Period:
30-45 Minutes
(Discussion between tutor and groups on the process of the PBL)

APPENDIX D

PBL TUTORING INTERVENTION

LEVEL I PROBLEM SET

Tutoring Session: 60-90 Minutes

Introduction of the Problem: 10 Minutes

A patient approaches you during a football game. You immediately notice there is blood running down his left leg. He presents with a significant turf burn to his anterior-lateral low leg. The burn is approximately 23cm long and varies in width from 2cm-10 cm. There is notable skin loss.

Inquiry/Discovery Period: 45 Minutes *(Your group must identify and answer the following questions)*

1. What would you do in this situation? Why or Why not?

2. What treatment is warranted for this injury? Why or why not?

3. What is the long term care?

Rebuttal Questioning Period:

30 Minutes

Students will be provided the opportunity to question the tutor probing for additional information before independent work commences during the week.

Instructor provides these guidelines at the end of the session.

PBL Solution

Independent & Group Work Period:

Over the course of the next week work on formulating a presentation of the problem solution by answering each of the four questions listed above as well as providing insight from the following questions:

1) What is the most significant concern when treating this patient?

2) During the course of treatment, the patient begins to suffer from blisters and signs of infection. What do you do to protect this patient?

3) Does this patient return to play? Why or why not?

Present your findings and your solution to the researcher next week prior to focus group discussion. You will have approximate 15-20 minutes for your group to present your problem.

APPENDIX E

PBL TUTORING INTERVENTION

LEVEL II PROBLEM SET

Tutoring Session: 60-90 Minutes

Introduction of the Problem: 10 Minutes

William is a 15 year old soccer athlete who has chronic sciatic nerve irritation to his left leg. He is reluctant to perform during practice and games due to the increase of pain. This hesitation also impairs his willingness to see the athletic trainer at his high school. The team physician wants him to work with the athletic trainer to treat his symptoms as well as create a rehabilitation plan.

Inquiry/Discovery Period: 45 Minutes *(Your group must identify and answer the following questions)*

1. Describe the differential diagnosis you would use to rule out the cause of the chronic irritation.

2. What treatments would be beneficial for this condition? Why or why not?

3. What rehabilitation programs would be beneficial for this condition?

Rebuttal Questioning Period:

30 Minutes

Students will be provided the opportunity to question the tutor probing for additional information before independent work commences during the week.

Instructor provides these guidelines at the end of the session.

PBL Solution

Independent & Group Work Period:

Over the course of the next week work on formulating a presentation of the problem solution by answering each of the four questions listed above as well as providing insight from the following questions:

1) What is the most significant concern when treating this patient?

2) During the course of treatment, the patient begins to suffer from bilateral paresthesia. What do you do in this situation? What could be the underlying condition for this new symptom?

Present your findings and your solution to the researcher next week prior to focus group discussion. You will have approximate 15-20 minutes for your group to present your problem.

APPENDIX F

PBL TUTORING INTERVENTION

LEVEL III PROBLEM SET

Tutoring Session: 60-90 Minutes

Introduction of the Problem: 10 Minutes

"Johnny Fernandez, ATC, LAT has been practicing athletic training for the past 20 years. Mr. Fernandez hired a new assistant during the summer, Adam Brown, ATC, LAT who recently graduated from graduate school. Mr. Brown is highly respected for his work in rehabilitation techniques and advanced treatment options for musculoskeletal injuries.

Mr. Fernandez recently discovered the men's basketball program is not pursing preventative measures prior to practice. Several of the student-athletes are complaining of severe lower leg pain during activity. This issue is beginning to debilitate a couple of key individuals on the team. Mr. Fernandez started the team on a preventative-stretching program as indicated by recent injuries. Mr. Brown observes dated (traditional) techniques used by Mr. Fernandez and offers to assist with the program.

After several weeks of the assisting Mr. Fernandez, Mr. Brown grows weary ofthe lack of progress the traditional program provides. Brown approaches Fernandez regarding his frustration and notes he believes more aggressive modern techniques will drastically help the men's basketball team. Both men present a strong exchange of ideologies, and each one of them displays frustration. After a lengthy exchange of words, the men agree to disagree and part ways on the matter.

The next day Mr. Fernandez asks Mr. Brown to discuss the incident with him, Mr. Brown agrees and the two meet to discuss this issue.

Inquiry/Discovery Period: 45 Minutes *(Your group must identify and answer the following questions)*

1. What rehabilitation techniques would be classified as traditional techniques? Conversely, what differentiates modern rehabilitation techniques from traditional?

2. What rehabilitation strategies should be implemented for a preventative program?

3. The other assistant athletic trainer observed the "conversation" between Fernandez and Brown and is concerned that Brown is unwilling to see a different perspective and point of view. How should this assistant approach this situation?

4. How can Fernandez and Brown resolve this issue?

Rebuttal Questioning Period:

30 Minutes

Students will be provided the opportunity to question the tutor probing for additional information before independent work commences during the week.

Instructor provides these guidelines at the end of the session.

PBL Solution

Independent & Group Work Period:

Over the course of the next week work on formulating a presentation of the problem solution by answering each of the four questions listed above as well as providing insight from the following questions:

1) What are the advantages and disadvantages of working collaboratively on a preventative rehabilitation program?

2) Explain the process of a preventative rehabilitation program that incorporates the SAID and DAPRE principles.

3) Apply the SAID and DAPRE principles to create a preventative rehabilitation program for the men's basketball team.

Present your findings and your solution to the researcher next week prior to focus group discussion. You will have approximate 15-20 minutes for your group to present your problem.