IMPLICATIONS OF CONSTRUCTIVIST PEDAGOGY IN TEACHER EDUCATION:

A COMPARISON OF PROBLEM-BASED LEARNING VS. NON-PROBLEM-BASED LEARNING IN TEACHER EDUCATION PROGRAMS

A Dissertation
Submitted to the Graduate School
Of
Tennessee State University
In
Partial Fulfillment of the Requirements
for the Degree of
Doctor of Education

Graduate Research Series No._____ 
Deborah McCormick Peterman
August 2012
IMPLICATIONS OF CONSTRUCTIVIST PEDAGOGY IN TEACHER EDUCATION:

A COMPARISON OF PROBLEM-BASED LEARNING VS. NON-PROBLEM-BASED LEARNING IN TEACHER EDUCATION PROGRAMS

A Dissertation
Submitted to the Graduate School
Of
Tennessee State University
In
Partial Fulfillment of the Requirements
for the Degree of
Doctor of Education

Deborah McCormick Peterman

August 2012
To the Graduate School:

We are submitting a dissertation by Deborah McCormick Peterman entitled “Implications of Constructivist Pedagogy in Teacher Education: A Comparison of Problem-Based Learning vs. Non-Problem-Based Learning in Teacher Education Programs.” We recommend that it be accepted in partial fulfillment of requirements for the degree, Doctor of Education in Curriculum and Instruction.

____________________________
Beth Christian
Chairperson

____________________________
John Mark Hunter
Committee Member

____________________________
Reney McAtee
Committee Member

____________________________
Karen Stevens
Committee Member

Accepted for the Graduate School

____________________________
Michael Orok
Dean of the Graduate School
DEDICATION

This dissertation is dedicated to my father, a man of stature, whose greatest gifts to his children were the value of a hard day’s work and the gravity of earning respect. My father ruled with an iron fist, that when opened, somehow became velvet. I know he would be proud to see his baby girl “stay the course” and earn a degree that will allow me to continue the journey that is my passion…teaching.

Thank you, Dad. You are with me every day and your wisdom and strength has been and will be passed on to those I am fortunate to teach.
ACKNOWLEDGMENTS

No one can make it through this process solo. Support and love from my family has become immeasurable. Those people made me realize that even an “old lady” could still learn! Blake, my son, your intelligence is the light I strive to reach. My love for you goes beyond. A huge thank you to Amy for taking care of the girls and me. You made this possible, my friend.

I owe so much to the folks at Tennessee Tech who believed in me from day one. Dr. Gore, my friend and landlord (at times), you inspire me with your knowledge of education and the grace you somehow never lose. Dean Smith, your guidance, support, and pep talks are the reasons I am still here. To all the professors who have given me the opportunity to continue learning, I thank you…and Dr. Z, you taught me the value of questioning the world and taking nothing at face value. You will never know how beneficial that skill has become in my life and I thank you.

My committee at TSU has been THE best group of people to work with and I want each of you to know that I realize how lucky I am to have had you in my corner. Dr. Hunter, gosh I have learned so much from you. Dr. McAtee, my PBL partner in crime, I am so thankful to have met you and I am hoping the opportunity for us to continue to work together will be a given. Dr. Stevens, one of the most genuine human beings I have ever known, I want you to know that I have learned much more than leadership skills from you. My chairperson, Dr. Christian, thank you so much for the time and energy you have put into guiding me along this path. Your promptness with replies and suggestions
for improvement kept me focused. I am so proud and fortunate you agreed to be my chair. I appreciate it!

My last words of gratitude are for Dr. Julie Baker. Life in Chattanooga was so much easier because of your friendship and partnership at our 2+2 site (and beyond). Your family has become a joy for me and I love “my boys” very much. Your guidance, unending hours of reading and editing, and above all encouragement have truly made this journey achievable for me. Your perseverance and toughness are amazing and I am honored to be able to work with you. “Thank you” could never be enough.
ABSTRACT

DEBORAH MCCORMICK PETERMAN. Implications of Constructivist Pedagogy in Teacher Education: A Comparison of Problem-Based Learning vs. Non-Problem-Based Learning in Teacher Education Programs (under the direction of DR. BETH CHRISTIAN).

Traditional instructional strategies practiced in teacher education programs do not generate autonomous and critical thinking. There is limited available research on the effectiveness of the constructivist method of problem-based learning (PBL) in college education courses. The main purpose of this study was to explore differences in the state licensure exam scores (Praxis II Principles of Learning and Teaching, PLT) between pre-service teachers who participated in PBL and pre-service teachers who did not participate in PBL in their content courses. The quantitative data for this mixed-methods study with a descriptive causal comparative design came from the PLT raw scores of a convenience sample of 263 pre-service teachers enrolled in seven off-campus cohort groups. The qualitative design for this study was interpretivist and the data stemmed from nine professors who taught content courses at the off-campus sites. Insights from 43 pre-service teachers’ reflections were also included in the qualitative data in order to support themes found throughout interviews the researcher conducted with participating professors. The conclusion for the group of pre-service teachers who participated in the PBL implementation is that the PBL method of teaching did not help or increase the candidates’ content knowledge and pedagogy as measured on the PLT state licensure
exam. The analysis of the qualitative data, however, implied that both professors and pre-service teacher participants viewed parts of the PBL process to be valuable in the promotion of critical thinking and freedom of student choices throughout the process.
# TABLE OF CONTENTS

Chapter

I. INTRODUCTION ............................................................................................ 1
   Background ................................................................................................. 3
   Statement of the Problem ........................................................................ 4
   Purpose of the Study .................................................................................. 5
   Significance of the Study .......................................................................... 5
   Research Questions ..................................................................................... 7
   Limitations of the Study ............................................................................ 7
   Definition of Terms .................................................................................... 8

II. REVIEW OF THE LITERATURE ................................................................. 11
   Origin of Constructivist Pedagogy .............................................................. 12
   History of Problem-based Learning ............................................................ 14
   Characteristics and Models of Problem-based Learning ......................... 16
   Benefits of Problem-based Learning Pedagogy ......................................... 19
   Limitations of Problem-based Learning Pedagogy .................................... 21
   Implications of Problem-based Learning and Teacher Education ............ 24
   Implications of Problem-based Learning on High-Stakes Testing
     Testing in Teacher Education ................................................................. 28
   Implications for Future Research on Problem-based Learning ............... 30
   Summary ...................................................................................................... 32

III. METHODOLOGY ......................................................................................... 34
Research Questions……………………………………………………………….35
Research Design…………………………………………………………………36
Context and Participants…………………………………………………………36
Implementation of the Problem-based Learning Process……………………39
Quantitative Methods……………………………………………………………40
  Quantitative Data Collection and Procedures…………………………….43
  Hypothesis………………………………………………………………………44
  Quantitative Analysis of Data………………………………………………44
Qualitative Methods……………………………………………………………45
  Qualitative Research Questions………………………………………….46
  Qualitative Data Collection and Procedures…………………………….46
  Triangulation……………………………………………………………………47
  Procedures……………………………………………………………………..47
  Interviews and Student Reflections………………………………………..48
  Qualitative Analysis of Data………………………………………………49
Summary…………………………………………………………………………51

IV. DATA ANALYSIS AND RESULTS………………………………………….52
  Quantitative Data……………………………………………………………52
  Quantitative Data Analysis………………………………………………56
  Qualitative Data and Analysis……………………………………………58
    Fieldnote Data…………………………………………………………….64
  Pre-service Teacher Reflections………………………………………….66
Summary ..............................................................................................................69

V. CONCLUSIONS AND RECOMMENDATIONS ...........................................71

Conclusions ........................................................................................................72
Implications .........................................................................................................75
Recommendations ..............................................................................................77
Summary .............................................................................................................79

REFERENCES ....................................................................................................81

APPENDICES ....................................................................................................89

A. The Dog Ate My Homework Resources .........................................................90
B. Demographics for Teacher Education Professor Participants .....................109
C. Interview Questions .......................................................................................111
D. Invitational Letter for Faculty Members at Four-Year University ....................114
E. Faculty Member Consent Forms ......................................................................116
F. IRB Approvals ................................................................................................118
LIST OF TABLES

1. Professor-Participants’ Demographics.........................................................38
2. Professor Interview Themes........................................................................51
3. Descriptive Statistics for Participants, including Missing Cases...............53
4. Descriptive Statistics for Participants after Removal of Missing Cases........53
5. Distribution of Candidates in PBL and Non-PBL Groups............................56
6. Mean and Standard Deviation of Groups....................................................56
7. Analysis of Covariance with PLT as the Dependent Variable....................57

Figures
1. Box & Whisker Plot Illustrating Absence of Outliers.................................54
2. Histogram Illustrating Normality of PLT Scores..........................................55
3. Profile Plot Illustrating Differences between PBL and Non-PBL Groups.......58
CHAPTER I

INTRODUCTION

Current elementary and secondary students are immersed in massive amounts of ever-changing information that requires them to reason and think through complex situations and to be able to defend the thinking that led them to their solutions (Spencer, 2012). Yet traditional pedagogy that focuses on rote learning for positive test-taking outcomes often does not promote critical thinking. According to Marshal & Horton (2011), traditional strategies such as lecture, direct instruction and memorization must be replaced by strategies that advance students’ critical thinking that is imperative for the future. However, traditional instructional strategies are deeply rooted in scholarship and many educators are unwilling to relinquish control of the learning process (Hmelo-Silver, 2004). A shift in conventional didactic strategies would cause many teachers to address the limitations of their own thinking and to examine the pedagogy to which they have adhered for years. In order to address the educational demand for increased analytical thinking by students, changes in curricula and pedagogy must occur across multiple disciplines (Hmelo-Silver, 2004). A logical place to implement necessary change is in the preparation of novice teachers. Teacher education programs must require students to
practice innovative instructional strategies that elicit critical thinking and problem solving.

Teacher quality is a challenging issue for many parents, educators, and policymakers. Fifty-five percent of Americans identified the quality of teachers to be “the greatest influence on student learning” (Klemme, 2008, p. 61). Educators who fail to implement effective teaching strategies will put students’ learning at risk. Traditional teaching methods such as lecture, drill, and superficial “covering” of standards (Spencer, 2012), often do not bring about the level of critical thinking skills needed in the complex school settings of today. Spencer stated that today’s students “ought to be able to navigate complex problems to be full, functioning, and active global citizens” (p. 79).

Worldwide expansion of societies has placed educational environments on new ground in which analytical reasoning must become standard (Ellison, 2009). Thus it is crucial for teacher education programs to produce pre-service teachers who feel comfortable with extensive use of problem solving pedagogy in their classrooms. Yet problem solving becomes more difficult for teachers to use because of the complexity of situations they face: classroom management and organization, assessment of learning, differentiation demands, and the endless effort to build positive parent-teacher partnerships (De Simone, 2008). Problem-based learning (PBL) is one instructional method that provides opportunities for more effective learner-centered educational approaches. PBL involves an educational process that begins with an open-ended problem that initiates discussion among learners in order to develop multiple outcomes and solutions (Drew & Mardis, 2008). This study adds to the core knowledge on problem-based learning in teacher
education programs. This mixed method study addresses the relationship between PBL methodology and pre-service teachers’ abilities to establish viable solutions for educational problems as measured by the *Principles of Learning and Teaching* (PLT).

**Background**

Problem-based learning was introduced into medical school curriculum in the United States during the 1970s and 1980s (Donner & Bickley, 1993). Medical educational institutions linked this new pedagogy to the challenges of preparing medical students to learn in complex contexts that would mirror what they would eventually have to do in the real world of medicine (Palincsar, 2007). Over the last two decades, PBL curricula have been introduced and implemented at various levels in the educational setting due to the view that PBL ensures content learning, strengthens students’ problem-solving capacity, and enhances student-directed learning (Hmelo-Silver, 2004).

There are a number of pedagogical strategies aligned with PBL. Some of these strategies include authentic assessment, situated learning, cognitive apprenticeship, and case-based learning (Fischler, 2006). PBL builds upon learning theory consistent with constructivism. The teaching and learning process involved in PBL uses active, meaningful, student-centered inquiry during problem solving (De Simone, 2008). Thus the PBL process begins with problems that are open-ended and initiates meaningful discussions among learners as an effort to develop multiple outcomes and solutions. Learners cannot be expected to become professionals in their fields without being exposed to its culture, values, problems, and solutions. Yet traditional teaching methods
such as lecture and seatwork appear to be producing students who are not prepared for potential challenges they will encounter in their future careers.

Those involved in the educational process are persistently scrutinizing the future of education in our multifaceted world. Many parents and teachers are searching for educational methods that ensure the delivery of students who are equipped to face today’s complex challenges. PBL is one pedagogical approach that attempts to supply future teachers with authentic tools needed to make critical thinking a standard rather than an exception in their classrooms.

Statement of the Problem

K-12 students are not being taught to problem solve and many teachers do not know how to teach problem solving and critical thinking. Traditional instructional strategies being used in teacher education programs do not provoke independent and critical thinking. There is limited available research on the effectiveness of the constructivist method of problem-based learning in college education courses. Even less research has been conducted on the impact of problem-based implementation in the preparation of pre-service teachers and their competencies in authentic assessment as measured on their state licensing exams. An investigation into the effectiveness of the mandated methodology is essential in determining future best practices for the institution’s professors and its pre-service teachers.
Purpose of the Study

The purpose of this study was to investigate differences in the *Praxis II Principles of Learning and Teaching* (PLT) state licensure exam scores between pre-service teachers who were participants in the implementation and modeling of the PBL approach and pre-service teachers who were nonparticipants in PBL. The development of pedagogy through PBL was quantitatively measured by comparing PBL participants and nonparticipants’ raw scores on the PLT exam. A secondary purpose of this study was to qualitatively examine the perspectives of professors who implemented PBL in their college content courses during fall semester, 2011. The combination of these methodologies gave a unique perspective to this study, revealing both student performance indicators and teacher experiences within the instructional setting.

Significance of the Study

Reform movements in education are focusing more on K-12 students’ use of critical thinking in learner-centered, constructivist activities and less on traditional methodology such as memorization (Zhang, 2011). In Tennessee, the state in which this study took place, Tennessee Board of Regents (TBR) Teacher Education Redesign called *Ready2Teach* (www.ready2teach.org) is aimed at limiting traditional pedagogy of lecture in pre-service teacher education courses (Tennessee Department of Education, 2011). The *Ready2Teach* redesign has been developed, in part, to ensure the incorporation of constructivist methodology in teacher education courses and is mandated for all Tennessee Board of Regents (TBR) schools. The full implementation of this redesign is scheduled for Fall 2013. This TBR redesign is focused on preparing pre-service teachers
who will enter educational settings with the ability to demonstrate competency. One of the key goals of Ready2Teach is to ensure that pre-service teachers are well prepared to have a positive impact on student performance from day one, as well as each and every day they are in a classroom. A second goal for Ready2Teach pre-service teachers is to be able to work collaboratively within schools to enhance net results for students, schools, and communities (Tennessee Department of Education, 2011). The educational components of the teacher education curriculum focus on a constructivist methodology in the form of problem-based learning (PBL). PBL engages students in the learning process by requiring them to think critically, conduct research, and provide valid solutions to complex, real-world problems. Authentic scenarios are constructed for the students to solve and are delivered in modules. The tasks included in each scenario are aligned with salient school issues and needs (Hmelo-Silver, 2004).

The goals of Tennessee’s Ready2Teach initiative established the optimum domain in which to enable teacher candidates to create solutions for future issues and problems they will face from day one on the job. The PBL technique makes students take a self-directed approach to their own learning by generating questions, planning investigations, and evaluating possible solutions (De Simone, 2008). Teacher education instructors will benefit from this study by helping pre-service teachers make connections between PBL and their competencies in authentic assessment as measured on the Principles of Learning and Teaching included in the PRAXIS II Series of licensure exams. Through the use of PBL, pre-service teachers will enter their profession with a deeper content knowledge paired with the ability to apply teaching strategies in authentic, real-world
classrooms. In general, this research will augment the volume of knowledge about PBL pedagogy, specifically focusing on its use in current teacher education programs

Research Questions

This study employed both quantitative and qualitative methodologies as reflected in the following research questions. Research question one addresses the quantitative portion of the study, while questions two and three serve to address the qualitative investigation.

1. Do differences exist in Praxis II Principles of Learning and Teaching (PLT) exam scores between teacher education candidates enrolled in PBL cohorts and candidates enrolled in non-PBL cohorts?

Hypothesis: Differences exist in Praxis II Principles of Learning and Teaching (PLT) exam scores between teacher education candidates enrolled in PBL cohorts and candidates enrolled in non-PBL cohorts.

2. How do teacher education professors describe the experience as they implemented PBL in their college-level classrooms?

2a. What challenges and/or pedagogical concerns did the teacher education professors face as they implemented PBL in their college-level classrooms?

2b. What positive experiences and outcomes did the teacher education professors encounter as they implemented PBL in their college-level classrooms?

3. What do the teacher education professors consider essential elements of a successful PBL model?
Limitations of the Study

The quantitative research conducted for this study represented first efforts at obtaining evidence for the effects of PBL on pre-service teachers’ competencies in authentic assessment as measured by the Praxis II PLT scores. Findings may be flawed because of the lack of research and development in the nature and type of problems to use with pre-service teacher education courses. A small sample size, diffusion of treatment (interaction effect), and experimenter effects are possible threats to the validity of the study’s findings. The time frame for this study could be a limitation because of the length of time between student engagement in PBL and the actual date the students complete the Praxis II Principle of Learning and Teaching exam. An additional limitation for this research is the fact that cohort groups were chosen on a voluntary basis, thus no random selection, and not all cohorts participated. The main threat to internal validity in this study is that posttest differences between groups may be attributed to characteristics of the groups other than effects of the independent variables. Several standard limitations also exist for the descriptive design in addition to the absence of random assignment: causes are not single and simple but may be multiple and complex, and the variables were not manipulated (Best & Kahn, 1998).

Definition of Terms

*Authentic assessment* - A form of assessment that uses real-world tasks that enable learners to verify their understanding of skills and knowledge through application (Hager & Slocum, 2011).
Cohorts - Groups of students who enroll in (and complete together) a specific set of common courses that take place at regular times (Seifert & Mandzuk, 2006). This study will focus on cohorts that are comprised of groups of students who complete their freshman and sophomore year at community college sites then complete their junior and senior year at one of eight teacher education sites spread throughout eastern and middle Tennessee.

Case-based learning - Well-written cases that involve students in complex, authentic situations that encourage them to think like practitioners (Choi & Lee, 2009). Problem-based learning in teacher education uses authentic cases that require students to think critically in order to resolve real-life, complex classroom situations.

Cognitive apprenticeship - A teaching method in which an expert teaches a novice using guided practice, modeling, and scaffolding; the learning is collaborative and focused on real-world tasks (Dickey, 2008).

Constructivism - A principle of learning in which students become authors of knowledge as they actively construct new ideas or expand on old ones (Hausfather, 2001). This learning theory is a basic principle of problem-based learning.

Problem-based learning (PBL) - A learning process that begins with an open-ended, ill- structured problem that initiates discussion among learners to develop multiple outcomes and solutions (Drew & Mardis, 2008). Problem-based learning will be a mandated teacher education practice in all Tennessee Board of Regents institutions by Fall 2013. Problem-based learning implementation will be used as an independent variable in the quantitative portion of the study.
Praxis II series/Principles of Learning and Teaching (PLT) - A test designed to assess a beginning teacher’s knowledge of a broad range of job-related topics including classroom management, instructional design, and delivery techniques (Educational Testing Service, 2011). This particular dependent variable was chosen because this exam includes scenarios that parallel problem-based learning.

Situated learning - Learning in which students are engaged in authentic, collaborative learning environments that call for deeper (metacognitive) thinking skills; learning is situated in social and cultural settings (Zheng, 2010).

Traditional instruction/pedagogy - The extensive use of textbooks, lecture, seatwork, and teacher-centered activities in educational settings (Kalyuga, 2012).
CHAPTER II

REVIEW OF THE LITERATURE

High-stakes testing requirements for novice teachers together with K-12 students in the United States demand the ongoing need for reform in educational settings (Sutton, 2004). Modern educational reform movements have focused efforts to reverse the depreciation of our nation’s educational performance and ability to commercially compete in a global economy (Shannon, 2012). Shannon shed light on modern U. S. school reform by reviewing six competing positions including that of Arne Duncan, the current Secretary of Education. Though there were extreme differences among the six positions, all considered the lack of rigor in teaching practices, resilience, and imperative supports to be detrimental to the nation’s school systems. These same six agreed that an exemplary curriculum calls for “a flexible design and operation, patience and resolve, research-based decision making, or faith in the learning capacities of youths” (Shannon, 2012, p. 116).

Educational reform movements come in shifts and change frequently. The present-day revisions focus on a test-driven curriculum (Rose, 2011). One researcher (Sherman, 2009) stated the need for teacher education programs to “resist swings in the pendulum” (p.42) and focus on teaching methods that view students as individuals with distinct needs. Yet it appears to be a paradox for beginning teachers to value the
importance of the diversity of students’ learning styles when standardization is pervasive throughout teacher education programs.

A number of teacher education sites including Samford University and the University of Delaware (http://www4.nau.edu/eeop/eqcp/pbl) are implementing changes to their courses in order to enable teacher candidates to approach teaching practices in authentic ways. The hope is that student-centered learning can occur in light of standardization. One particular practice that will be fully implemented in the Tennessee Board of Regents teacher education sites by 2013 is the constructivist concept of problem-based learning. This review of literature will give an inclusive overview of this particular educational practice that has been used extensively in the medical field for several decades and sporadically in educational environments.

**Origin of Constructivist Pedagogy**

The development of constructivism and learner-centered education has a long history; the beginnings date back some 5000 years. Student-centered learning has roots in both philosophy and psychology. Confucius and Socrates are considered two of the first to emphasize the learner (Henson, 2003). Besides Confucius and Socrates, other great philosophers who believed in aspects of constructivism were Francis Bacon, John Locke, and Jean Rousseau, and John Dewey. These scholars believed the role of philosophy was to create a difference in thinking, not impact behavior (Henson, 2003).

John Dewey possibly had more influence on the philosophy of education than any American before or since. Dewey (as cited in Henson, 2003) stated, “Unless a given experience leads out into a field of previously unfamiliar no problems arise, while
problems are the stimulus to thinking” (p. 8). Dewey is also associated with the experimental learning theory, which emphasizes the creation and reform of experiences (Jai, 2010).

Psychological tenets of student-centered learning developed during the 20th century. Jean Piaget (though it appears many did not see Piaget as a constructivist) and Lev Vygotsky were two psychologists who contributed greatly to the idea of constructivism (Henson, 2003). Piaget is often referred to as a “forerunner of modern constructivism” (Jia, 2010, p. 197) and along with the more traditional constructivists, he believed that students’ cognitive development became a reality in the process of inherently acquiring knowledge (Jia, 2010). In other words, Piaget considered students to be the makers of meaning. Vygotsky is associated with social constructivism. This psychologist believed that knowledge comes through a focus on prior learning, race, class, gender, and culture of individual students. He felt that no learning could be accomplished independently due to the idea that learning is a social construction (Jia, 2010). Vygotsky claimed (as cited in Green & Gredler, 2002), “The teacher, working with the child, explains, informs, inquires, corrects, and forces the child himself to explain” (p. 57).

Revered philosophers and psychologists, such as Piaget and Vygotsky, agreed that all theories should guide thinking not just for the student but for the educator as well (Henson, 2003). The most powerful conviction evident in the words and writings of these scholars is that knowledge is temporary; ideas are deemed factual until future experiences and insights allow the learner to add to and enhance them (Henson, 2003).
According to Yilmaz (2008), constructivism is not a solitary learning theory; rather it is based on a multitude of outlooks. Though Matthews (2003) listed eighteen forms of constructivism, three distinct categories are prevalent throughout the literature: (1) social constructivism that is determined by values, beliefs, and ideologies, (2) psychological constructivism relating to a student’s background knowledge and the phenomena this knowledge is based on, and (3) radical constructivism that assumes all knowledge is constructed by the learner.

**History of Problem-based Learning**

The roots of problem-based learning (PBL) go back many decades to Kilpatrick (1918) and Dewey (1938) (as cited in Hmelo-Silver, 2004). In 1969, McMaster University in Toronto was the first to establish a PBL medical curriculum in North America. McMaster University adopted PBL as part of complete remodel in medical training in which fundamental sciences were learned through the analysis of typical medical cases. In addition, learner motivation based on student curiosity was a basic belief of those implementing the new model of PBL (Donner & Bickley, 1993). The PBL approach to teaching medical students began in the United States at the University of New Mexico in 1979. This University’s implementation of a constructivist methodology came in the form of an alternative track in which medical students could opt to learn through the student-centered method of PBL.

A small number of students chose to learn through PBL while traditional instruction was chosen by most of the medical students (Donner & Bickley, 1993). Mercer University School of Medicine located in Georgia fully implemented PBL in
1982 by making the technique its only curricular offering. Lectures were replaced by tutorial meetings and guided by faculty members, in which a small group of students learned basic science through an analysis of case studies. Mercer was the first university in North America in which a comprehensive science curriculum was delivered exclusively through PBL (Donner & Bickley, 1993).

Problem-based learning reached another milestone when it was adopted by Harvard University School of Medicine. The school linked this new pedagogy to the challenges of preparing medical students to learn in complex contexts that would simulate what they would eventually have to do in the real world of medicine (Palincsar, 2007). One of the intents of PBL in medical education is to equip students to, “apply basic knowledge in patient care” thus they “are not just advised to be lifelong learners; they are trained to be” (Donner & Bickley, 1993, p. 295). Problem-based learning has, in recent decades, become widely adopted in several university programs beyond medical curriculum, including social work, business, and architecture (Kwan, 2008). For example, the University of Hong Kong piloted a PBL model in which this methodology was used in social work theory and practice classes. Students began the process through basic problem solving involved in authentic casework. By the end of the PBL courses, the students were required to analyze a targeted community and plan an intervention (Lam, 2004).

The pedagogy of PBL made its way to the high school setting through a Bio Prep Program developed at the University of Alabama (Delisle, 1997). This program was designed to boost the number of minority and economically disadvantaged candidates
gaining entry into medical schools. Howard Barrows, one of the creators of PBL, was
drawn to the idea of introducing this innovative teaching and learning method into a high
school (Delisle, 1997). Barrows agreed to work with the Alabama school system while
developing an anatomy/physiology course for high school juniors and seniors. Problem-
based learning was implemented into this course with a focus on expansion of
autonomous learning and the importance of group collaboration (Delisle, 1997).

From the original implementation at McMaster University where PBL became
well-known, through gradual increased use in medical schools in the United States during
the 1970s and 1980s, problem-based learning has been utilized in many university
programs (Kwan, 2008). Internationally, the School of Business at Royal Melbourne
Institute of Technology (RMIT) used PBL in its redesign of an intelligent systems course
(Cheong, 2007). The field of nursing adapted PBL into training in which the students are
required to apply collective knowledge to actual clinical situations (Niemer, Pfendt, &
Gers, 2010). The use of PBL grew as a pedagogical technique in education after Lee
Shulman’s 1985 American Educational Research address in which he strongly urged
teacher educators to implement PBL (Floyd & Bodur, 2005).

**Characteristics and Models of Problem-based Learning**

Problem-based learning (PBL) emerged in response to general dissatisfaction with
education in the field of medicine. Specific content taught through lecture only gave
medical students nominal ability to apply the skills needed in their particular field of
study. Barrows (2002), an expert in the field of constructivist pedagogy of PBL,
identified the following key components of problem-based learning (PBL):
1. The problems are presented to the learner in the way they would present in the real world, as unresolved ill-structured problems, simulating the generation of multiple hypotheses about cause and management.

2. The learners have to assume responsibility for their own learning, determine what it is they need to learn and find the appropriated resources for the information from the world about them.

3. The teacher’s role is that of a guide or facilitator of learning; commonly referred to in PBL as a tutor.

4. The problems chosen are those most apt to be confronted by the learner in life and career. The skills and activities required of the learners are those valued in the real world-making PBL an authentic learning process. (pp. 119-120)

There are a number of pedagogical strategies (and names) that are aligned with PBL. Some of these strategies include authentic assessment, situated learning, constructivism, discovery learning, cognitive apprenticeship, and case-based learning (Fischler, 2006). The educational method of PBL is in line with the views of constructivism where the teaching and learning process use active, meaningful, student-centered inquiry during problem solving (De Simone, 2008). Barrows, a leading authority on problem-based pedagogy, asserted that PBL has one central goal and that is to target the building of knowledge through discourse (Barrows, 2002). Koray, Presley, Koksal, and Ozdemir (2008) defined PBL as an educational strategy that incorporates cooperative learning using small groups of students consisting of three to six individuals. These individuals are given roles and responsibilities during PBL discussions. Dochy, Segers,
Bossche, and Struyven (2005) called this group setting “the tutorial group” (p. 48) then added that this type of setting was an essential feature of the PBL method. It is within this framework of grouping that the learners must become actively involved while analyzing (discussing, comparing, clarifying, predicting, etc.) their problem. The group leader plays a major role by ensuring the group discussions remain focused and that the problem is fully investigated. Another important role in the PBL process is that of the group recorder who summarizes and records the group discussions (Kwan, 2008). Researchers Drew and Mardis (2008) stated that the PBL process begins with “an open-ended, ill-structured problem that would initiate discussion among learners to develop multiple outcomes and solutions” (p. 167). The PBL technique makes students take a self-directed approach to their own learning by generating questions, planning investigations, and evaluating the outcomes (Kwan, 2008).

Bridges and Hallinger (1997) claimed that PBL consists of two primary models. The first model is student-driven in which the learners are not given specific objectives or assignments. The students are required to explore the problem and come up with authentic learning objectives or points that need further investigation. These issues are then discussed during group meetings. The advantage of this approach, according to the authors, is that it offers flexibility, yet the learner may experience frustration because of the intended vagueness of what is to be learned. In the second PBL, the facilitator gives specific objectives and information to the students at the front end of the problem-solving process. The value of the second PBL model is that the students are able to incorporate more of what the facilitator feels is important in the final product. However, specific
directions, standards, and objectives given from another person, namely the facilitator, may hinder the students’ motivation and higher-level thinking.

The final outcomes for students involved in the PBL pedagogy consist of a variety of possible products including oral presentations, debates, role-plays, multi-media presentations, or written reports. All final products must incorporate relevant and sufficient research that substantiates each group’s decision-making process (McConnell, 2008). Regardless of how many steps or models that may be included in PBL pedagogy, three factors must be incorporated in order for the learning to lend itself to this constructivist method. The factors include the learner, the problems and problem endeavors, and finally the facilitator (Dochy et al, 2005).

Benefits of Problem-based Learning Pedagogy

Adults are more motivated to learn when the learning process includes their own experiences (Hmelo-Silver, 2004). Problem-based learning is an effective way for students to take an active role in the learning process. Since PBL is student-centered, the learners become the governing factor in the process (Kwan, 2008). Students engaged in the PBL technique share responsibilities for the planning and implementation of the learning experience. This ownership promotes student commitment, active participation, and a sense of progress toward their own goals. Problem-based learning, according to Bridges and Hallinger (1997), sparks internal motivation for the learners because the knowledge and skills needed in the process are applicable and realistic to students’ future personal and professional lives.
The learning strategies included in the PBL pedagogy can be used in a number of classes and discussions (Sungar & Tekkaya, 2006). For example, these researchers found that 10th grade students enrolled in a biology course using student centered learning were required to use strategies such as metacognition, calculated planning, and time management. Kwan (2008) added to the list of PBL benefits by stating that this non-traditional learning style can stimulate student thinking and thus lead to a broadening of minds. Kwan (2008) went on to name even more advantages of the PBL pedagogy, asserting that this particular method is seen as a “powerful learning process to enhance new knowledge construction and conceptual learning through systematic inquiry, integration, analysis and evaluation in a team collaborative manner” (p. 340). The use of student research throughout the PBL process is seen as an imperative part of the learning process. The learning resources used by students, especially reviews of literature, may be a “dynamic phenomena” (Hmelo, Gotterer, & Bransford, 2000, p. 394). While reading through related literature, additional issues may arise that direct the learners’ attention in other directions (Hmelo et al., 2000).

Emphasis on lecture and traditional class work often discourages a much-needed application of student research and critique (Donner & Bickley, 1993). These two authors went on to add the evidence of student attendance and preparedness in the PBL model. Students are expected to supply an equitable amount of information, thus absences are unacceptable to PBL groups. Askell-Williams, Murray-Harvey, and Lawson (2007) conducted a qualitative study on the use of PBL with 105 pre-service teachers in Australia. One of the positive outcomes of PBL for the participants was the feeling of
connections between case studies and real-life teaching situations. These researchers also found that students felt improvement in their personal and interpersonal skills practiced within the domain of abundant group work. Many participants recognized the benefits of the reflection techniques used throughout problem-based learning. These researchers found a final benefit of PBL to be an “opportunity for students to begin conducting themselves as teachers” (Askell-Williams et al., 2007, p. 7).

Fischler (2006) conducted a study on simulation-based learning in teacher education. The study examined three teacher education professors and their experiences with simulation-based learning. The professor who reported the most success with this student-centered pedagogy was the one who spent a significant amount of time (3-4 hours per week) on the front end of the activities. This professor also found positive outcomes of simulations in launching in-class discussions, as well as complementing lectures and group activities. This qualitative study indicated that constructivist pedagogy could be an effective instructional tool in teacher education college classrooms (Fischler, 2006).

Perhaps one of the most positive aspects of PBL is the student use of an analytical approach when explaining relationships between factors. Through consistent use of PBL, students become comfortable with self-directed analysis of problems that seemed insurmountable before, and thus self-directed learning becomes the norm rather than the exception (Hmelo et al., 2000).

Limitations of Problem-based Learning Pedagogy

Not all the benefits of PBL are supported by extensive research and most of the research has focused on higher education, predominantly in medical schools. Very little
research is available on PBL with K-12 students (Hmelo-Silver, 2004). The central core of PBL is based on a belief in deep content learning, yet it appears obscure how researchers pinpoint the depth to which participants have learned content in the course of the PBL method. Belland, French, and Ertmer (2009) did research on the validity of PBL in which three targeted issues were measured in 33 empirical studies. The researchers found that only a few studies included: a theoretical system for the variables to be measured, justifications for the pairing of assessments with the variables, and sufficient information that allowed readers to determine the validity of the findings and interpretations. Furthermore, these researchers concluded that only eight of the 33 empirical studies “gave appropriate evidence of reliability and dependability of test scores” (Belland et al., 2009, p. 79).

These researchers noted that the studies they reviewed involved PBL in the medical field only. They encouraged future PBL researchers to look more closely at measurement problems, especially if PBL is to be incorporated into the realm of general education including elementary, middle, and high schools. Belland (et al., 2009) finalized their research by stating “Taking these steps in a relatively young field of inquiry holds promise to serve as model for other areas of research” (p. 83).

Another limitation of PBL is faculty attitudes about “new” teaching techniques. Often college instructors (and classroom teachers) are reluctant to give up control of the learning process (Hmelo-Silver, 2004). The use of PBL would make teachers aware of the limitations of their own thinking by their need to re-evaluate the pedagogy many have followed for years. Thus this student-centered method runs the risk of becoming
implemented poorly and ultimately becoming routine (Fairbanks et al., 2010). According to De Simone (2008), the process of PBL (design, planning, and implementation) would be expensive. Also, having only a few professors or teachers who use PBL in a large faculty would not be sufficient and in turn would be an obstacle to implementation and benefits.

The University of Hong Kong conducted a trial exercise using PBL to teach a new Integrated Humanities course to a group of pre-service teachers (Kwan, 2008). Many of these students had master’s degrees and all had worked as educational psychologists in schools. After completing the course, the students completed a questionnaire about their experiences with the PBL method. Several disadvantages were recorded by the students including the belief that the activities were very difficult, poorly structured with unclear directions, and too time consuming. One of the biggest concerns the students had with PBL was the frustration of working collaboratively as a group. The fact that their individual grades depended on a group effort PBL process was motivating at first, but this feeling did not last long (Kwan, 2008). One of the participants noted, “I think PBL is a nice trial, but the learners may not have the foundation or the time needed to allow for thorough explorations that are needed to start the problem-based learning process” (Kwan, 2008, p. 335). Similar limitations of PBL were found in the Askell-Williams et al. (2007) research study conducted in Australia. Of the 105 student participants in PBL, the majority felt the benefits of this pedagogy would likely be put to the side when they transferred from student to teacher.
Passman (2001) conducted a study on the effect of teacher pressures (high-stakes testing and administration decisions) and the use of student-centered instruction. The study took place in a large mid-western urban school district. Passman observed a fifth grade teacher who had been introduced (and taught) using problem-based methods in teacher education. The observations took place over an entire school year. Passman found the teacher’s use of constructivism in the classroom was evident during the first half of the year. After attending a faculty meeting, the fifth grade teacher changed the classroom to traditional instruction. The arrangement of the classroom into straight rows was evidence of the teacher’s change in attitude about PBL. Passman’s research found that the principal of the mid-western urban school had made the following announcement at the faculty meeting: “Don’t teach anything that isn’t on the achievement test” (Passman, 2001, p. 195). Learning to be a constructivist, student-centered teacher is difficult enough when it is encouraged, but when administration forces high-stakes testing into the process, it makes the process almost impossible (Passman, 2001).

**Implications of Problem-based Learning and Teacher Education**

De Simone (2008) stated, “Current educational reform movements emphasize preparing teachers for pedagogical problem solving in the classroom” (p. 179). Yet problem solving becomes more difficult for teachers to use because of the complexity of situations they face: classroom management and organization, assessment of learning, differentiation demands and the endless effort to build positive parent-teacher partnerships (De Simone, 2008). In the majority of K-12 situations, teachers are required to assess students in a single subject area, and it would require careful planning to make
PBL effective in 50-minute class periods (Hmelo-Silver, 2004). Furthermore, the PBL approach allows students to validate their work and assess the quality of their learning instead of sitting passively in an elementary or high school classroom (Drew & Mardis, 2008).

Koray et al. (2008) conducted a research study using 85 pre-service elementary teachers. The purpose of this study was to give the students an opportunity to understand the problem solving process. At the end of an eight-week PBL curriculum focus, the teacher education students presented their final products in several ways including PowerPoints, magazines, newspapers, and web pages. Two groups reported that it had taken three weeks for them to become comfortable with the process. However, 30% of the students concluded that PBL had a positive effect on their self-confidence about problem solving. One of the students went on the say, “This PBL approach taught us the importance of putting commas and struggling with all types of obstacles and problems instead of putting a dot and giving up” (Koray et al., 2008, p. 12).

De Simone (2006) conducted a quasi-experimental study that examined the impact of PBL on pre-service teachers’ problem solving abilities. Two classes were included in the research. One class, the experimental group, used PBL method of learning. The dependent measure was the groups’ analyses of a problem. A pre-test included an authentic case that required the teacher candidates to participate in decision-making for a terminally ill student. The post-test authentic problem dealt with the ramifications of improper grouping of students from different cultures. Both cases were reviewed and approved by a panel of instructors who taught in a one-year teacher
education program. The researcher, using a multivariate analysis of variance (MANCOVA), determined that the participants using the PBL approach were significantly better than the control group in finding the main problem, creating abundant solutions, and using multiple resources to support their final solution (De Simone, 2006).

A mixed-method study (Levin, Hibbard, & Rock, 2002) on the use of PBL and pre-service teachers in a special education course was conducted in a medium-size southeastern United States four-year university. The participants included 44 pre-service teachers who were enrolled in two cohort groups, and all students were juniors in their second semester. The PBL process was conducted during two-hour seminars throughout the semester. The seminars coincided with 10 hours of student internships in classrooms that were using inclusion for students in special education. Implementation of a typical PBL format was used and the pre-service teachers were randomly grouped and given the following real-life scenario: “You are a third-year teacher who is asked by your principal to take a newly formed inclusion classroom for the upcoming year. What do you need to know to make an informed decision?” (Levin et al., 2002, p. 282).

The data for this study included the students’ initial response papers, final decision papers, and pre/post scores on a survey about beliefs on the concept of inclusion (Levin et al., 2002). The t-tests used for the survey scores were significant at the .05 level for both groups. This finding showed that the pre-service teachers held somewhat more favorable beliefs about inclusion at the end of the semester and upon completion of the PBL activities. The qualitative data were used by the researchers to conduct a content analysis of common questions and concerns that were found in the students’ initial and
final decision papers. Two major elements on the effectiveness of PBL became evident in this study. First, rather than learning in the traditional teacher preparation setting, the students felt they learned more through engaging in research on various disabilities required in the PBL process. Second, the group discussions held in conjunction with their internships and the PBL activities allowed the students to engage in authentic debate on the issues surrounding inclusion classrooms. The limitations of the study included the effects of the newness of PBL on the participants, most of the data hinged on participants self-reports, and many of the participants may have focused more on being politically correct and pleasing the instructors rather than giving real thoughts and beliefs in the qualitative data. An overall conclusion the researchers came to was the use of PBL in these particular cohorts of pre-service teachers helped build a better understanding and foundational knowledge in regards to inclusion classroom settings (Levin et al., 2002).

The shift to PBL over the last several years seems to coincide with the demand for the use of technology in teacher education programs. Technology and learning are expected to be “robust, interactive, and self-directed” (Oberlander & Talbert-Johnson, 2004, p. 2). Many PBL applications have been created online and serve as excellent examples. Through technology, instructors have the opportunity to explore a wide variety of software that enhances investigations and allows students to effectively organize and present their ideas (Drew, 2008).

A federal grant, Preparing Tomorrow’s Teachers to Use Technology (PT3), provided funding for a qualitative study on the use of technology in teacher education courses at Brigham Young University (Draper, Smith, & Sabey, 2004). The authors
incorporated the use of PBL into the study because they wanted to base teacher education instruction on “current learning theory and confront the task of providing our students with sufficient knowledge and appropriate skills needed for teaching and solving instructional problems” (pp. 31–32). As a way of augmenting the PBL style, the researchers integrated technology with the use of Web Quests. According to the authors (Draper et al., 2004), Web Quests require students to think analytically while synthesizing and evaluating. Data were gathered from teaching logs, student surveys, participant artifacts, and evaluations. The analysis of the data was conducted using “national science, literacy, and technology standards for teachers” (Draper et al., 2004, p. 37). The results indicated the use of Web Quests in teacher education courses were beneficial in two areas. One was student acquisition of vital knowledge and skills in order to teach elementary reading and science. The second benefit was the way in which the integration of technology and PBL modeled future ways the teacher candidates might incorporate technology into their own classrooms (Draper et al., 2004).

**Implications of Problem-based Learning on High-Stakes Testing in Teacher Education**

Future teachers (and K-12 students) continue to face formidable challenges due to testing requirements. Vaughn and Everhart (2005) wrote, “Higher scores on exit tests for future teachers, for higher, more nationally competitive scores on standardized tests for K-12 students and pre-service teachers have generally faced disappointing results” (p. 5). A decade ago, only 46.9% of new teachers in Massachusetts passed the new state-required teacher licensure exams (Massachusetts Educator Certification Tests). The
struggle to find the best integration of pedagogy and content knowledge for pre-service teachers marches on (Vaughn & Everhart, 2005). Teacher quality has been an on-going issue for many including parents, educators, policy makers, and the American public. Fifty-five percent of Americans identified the quality of teachers to be “the greatest influence on student learning” (Klemme, 2008, p. 61). Candidates seeking permanent licensure to teach in elementary or secondary schools in most states are required to pass a set of certification exams (Burke, 2005). New York’s Board of Regents voted to consider “closing teacher-training programs if 80% of their graduates cannot pass certification exams” (Burke, 2005, p. 785). Congress addressed the issue of teacher preparation in the 1998 reauthorization of the Higher Education Act. This act requires colleges and state governments to report the passing rate on licensure exams. Additional exploration on the quality of teachers was adopted in the No Child Left Behind Act of 2001. This enactment requires schools to hire highly qualified teachers (defined so by passing state licensure tests). Some states develop their own standards for approval of teacher education programs, and many states look to other organizations to develop such standards. The National Council for Accreditation of Teacher Education (NCATE) is one of these organizations (Klemme, 2008). In 2001, NCATE addressed the need for greater precision in teacher education program by placing stronger attention on the knowledge bases for teacher preparation (Vaughn & Everhart, 2005).

Thirty-four states require pre-service teachers to pass one or more components of the Praxis II exam for licensure and certification (Klemme, 2008). The Praxis II exam includes three separate types of tests, The Subject Assessment, The Teacher Foundations,
and the Principles of Learning and Teaching (PLT). The PLT measures general pedagogical knowledge at four grade levels: early childhood, K-6, 5-9, and 7-12. The PLT tests are designed to assess a beginning teacher’s knowledge of a broad range of educational topics. This particular Praxis II test uses a case study approach and features four case histories that require written responses (Klemme, 2008). Many teachers whose careers are stalled (or derailed) by failing the PLT test claim the tests have little to do with their teacher education preparation or their performance in the classroom. There is an apparent disconnect between philosophy and best practices in teacher education programs and the authentic assessment of licensure candidates (Vaughn & Everhart, 2005).

**Implications for Future Research on Problem-based Learning**

Future steps must be taken to legitimize the PBL methodology (Kwan, 2008). There is a great need for “evidence-based instructional strategies that demonstrate which facets of problem-based learning are important for particular kinds of outcomes so that educators can make informed choices in adopting PBL to their particular contexts” (Hmelo-Silver, 2004, p. 260). Field placement performances can be used to assess student growth and program effectiveness, yet limited research has been conducted in this area of teacher education (Vaughn & Everhart, 2005).

More research is needed on the relationship between PBL pedagogy and Praxis II teacher licensure tests to “determine the predictive value of any component of the tests on success as a classroom teacher” (Burke, 2005, p. 790). Further research is also recommended for comparing the Praxis II results with summative evaluation at the end of
the first year of teaching (Burke, 2005). There is a need for research that will help identify what teacher educators can do beyond the use of traditional programs of professional knowledge to advocate more critical-thinking and adaptive teachers. Also, much more data is needed in the area of increasing daily pressure and its impact on teacher strength in constructivist pedagogy (Fairbanks et al., 2010).

The goals of PBL include helping students develop knowledge that is flexible, problem solving skills that are effective, general skills of problem solving, collaborative skills, and motivation that comes from within. There is a sizable amount of research on the first three goals of PBL but little research on the last two goals. Also, minimal research is found outside the medical field and gifted education. Understanding how the less skilled can reach these goals is an important research focus for PBL (Hmelo-Silver, 2004).

The pedagogy of PBL appears to support learning in undergraduate and professional educational settings, but little research has been conducted on PBL use with younger students (Hmelo-Silver, 2004). Few studies have looked at performance measures on learning strategies and even less research has been conducted on the long-term effects of PBL as it relates to student directed learning (Evensen & Hmelo, 2000). These authors discussed the complexities of research on PBL that would require sophisticated and novel methodologies. Evensen and Hmelo (2000) also stress the research limitations potentially caused by inadequate population samples.
Summary

People learn in many different and complex ways. They learn by being told, by comparing and contrasting information, by discussing with others, by watching a task being performed, by making and testing predictions, by reading, by trial and error, and by a myriad of other activities. Therefore, what is needed in education is an eclectic view on learning (De Corte, Verschaffel, Entwistle, & Merrienboer, 2003). Unfortunately current instructional design is moving very slowly toward this constructivist view. Instead, theories and models are typically founded in one “familiar” paradigm that focuses on particular types of learning while ignoring others.

Learners cannot be expected to become professionals in their fields without being exposed to its culture, values, problems, and solutions. Problem-based learning is one pedagogy that attempts to address a variety of concepts such as problem parents and homework issues included in authentic professionalism that is a growing need among educators old and young alike. There are many pros and cons to the PBL process, and a great deal of future research is needed for this student-centered approach to be fully implemented in teacher education programs across the country. The literature reviewed in this chapter indicated PBL has advantages as well as drawbacks. The benefits of PBL pedagogy including student ownership, responsibility, and motivation due to the authenticity were evident in Kwan’s study (2008) as well as in Bridges and Hallinger’s research (1997). Hmelo-Silver (2004) found, like other researchers, motivation from learner experiences is a major benefit of this pedagogy. Hmelo-Silver (2004) and others have also indicated the limited amount of research as being a drawback to PBL. Passman
(2001) gave insight into the negative impact of high-stakes testing on the successful implementation of PBL. De Simone (2008) brought in both pros and cons to the use of PBL in teacher education programs. According to De Simone (2008), current educational reform has targeted the need for emphasis on problem solving in teacher preparation, yet the myriad of issues teachers have to face make problem solving difficult and adds to demands already in place.

School reforms are being called for at all levels of education and strong teacher education programs are imperative if these reforms are to succeed. The formal training of teacher candidates in Tennessee is heading toward a huge pedagogy shift. The TBR Teacher Education Redesign is moving toward student-based learning with a minimum amount of seat time in traditional courses. This redesign will ultimately be subject to all the limitations found in this literature. The hope is that the benefits found in this review will be found in Tennessee’s new teacher pedagogy as well.
CHAPTER III

METHODOLOGY

Chapter three describes the methods that were used to examine the differences between the *Praxis II Principles of Learning and Teaching* (PLT) state licensure exam scores between pre-service teachers who were participants in the implementation and modeling of the PBL approach and pre-service teachers who were nonparticipants in PBL. Quantitative procedures include a statistical analysis of the PLT scores from a sample of pre-service teachers. Since this study was based on ex post facto data, a descriptive, causal comparative design was used. The primary independent variable was the method of course content delivery (PBL vs. non-PBL), and the dependent variable included the PLT scores. This particular dependent variable was chosen because this state-required exam includes teaching and learning scenarios that parallel PBL.

Additionally, qualitative methodology included interviews and inductive analysis. While the quantitative measures focused on test scores of the pre-service teachers, the qualitative data added to the study by examining the professors’ perspectives on their use of PBL in content methods courses. The paradigm for the qualitative portion of the study
is interpretivist (Bogdan & Bilken, 2007), with a goal of understanding the implementation of PBL from the professors’ points of view.

Chapter three outlines the research design including the research questions, a description of the participants, along with the variables and instrumentation used in the research. Procedures for data collection will follow and conclude with an explanation of how data analyses were conducted.

**Research Questions**

A descriptive, causal comparative approach was used to answer the quantitative research question framing this study, and an interpretivist research paradigm guided the qualitative research questions:

1. Hypothesis: What differences exist in *Praxis II Principles of Learning and Teaching* (PLT) exam scores between teacher education candidates enrolled in PBL cohorts and candidates enrolled in non-PBL cohorts?
2. How do teacher education professors describe the experience as they implemented PBL in their college-level classrooms?
   2a. What challenges and/or pedagogical concerns did the teacher education professors face as they implemented PBL in their college-level classrooms?
   2b. What positive experiences and outcomes did the teacher education professors encounter as they implemented PBL in their college-level classrooms?
3. What do the teacher education professors consider essential elements of a successful PBL model?
Research Design

The quantitative design for this mixed-methods study was descriptive based on the fact that the PBL implementation and the *Praxis II Principles of Learning and Teaching* (PLT) exams had already taken place by the time the test score data were collected. Under the descriptive design umbrella, the ex post facto study also took on a causal-comparative design in order to answer the question of differences between groups. One group of pre-service teachers was exposed to the implementation of PBL methods in their content classes. That PBL group was compared to another group of pre-service teachers whose instructional methods did not utilize PBL pedagogy in their content courses. Both groups were taught by the same set of professors.

Each professor involved in this study experienced the PBL approach from an individual point of view. The interviews conducted for this research were analyzed using the interpretivist framework for qualitative design. Bogdan and Biklen (2007) characterize the use of qualitative methods as ideal to explore a concept “as it is understood in the context of all those who use it” (p. 29). The qualitative portion of this study was based on authentic descriptions of PBL by those immersed in the process. Thus the data gathered from the participating professors and pre-service teachers were quintessential for the overall findings of this research.

Context and Participants

The participants for this study included a convenience sample of pre-service teachers in their content area methods courses. A convenience sample, rather than a randomized sample, was used due to the limited availability of research participants in
the cohort setting. This setting consisted of groups of students enrolled in (and completed together) content methods courses.

The PBL group in this study consisted of approximately 100 junior and senior (combined) pre-service teachers enrolled in content methods courses required for teacher education majors. This group was enrolled in a four-year public university during the fall semester of 2011. However, these pre-service teachers traveled to seven different off-campus teacher education programs located in suburbs of several various southeastern cities. These students completed their first two years in teacher education at community colleges and their last two years at off-campus sites in partnership with the four-year university. The PBL group of pre-service teachers was made up of approximately 90 females and 10 males, all between the ages of 20 and 40.

The non-PBL group of pre-service teachers included a sample of approximately 100 junior and senior pre-service teachers who attended the same seven off-campus teacher education sites during the fall semester of 2010. Both the PBL group and the comparison group (students who did not participate in PBL methodology) had the same instructors. To help adjust for ability between the two groups, each student’s ACT score and GPA were used as covariates.

The professors involved in PBL implementation were participants for the qualitative procedures. A total of nine professors from the Department of Curriculum and Instruction volunteered to participate in the study (see Table 1). Eight of these professors were female and one was male. Included in these participants were five associate professors, two assistant professors, and two instructors. Three associate professors had
taught at their teacher education sites for eight years and the remaining associate professors had taught for seven years. The two assistant professors had taught for six years, and the instructors had both taught at their respective sites for four years.

The role of a qualitative researcher can be complex to manage. The researcher for this study was an instructor with four years of service and was involved in the implementation of PBL in content classes as well. Thus the role took on a personal quality throughout each step of the qualitative research. The interview process lends itself to the researcher’s instinct to use empathy in order to make the participants feel more relaxed, thus more willing to answer questions honestly. One of the difficulties this researcher strived to overcome was the notion of “skewing” the analysis of data. The absence of anonymity involved in interviews made it challenging for the researcher to arrive at conclusions that did not appear disloyal or unjust to the participants.

Table 1

Professor-Participants’ Demographics

<table>
<thead>
<tr>
<th>Title</th>
<th>Rank</th>
<th>Years of Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor Dixie</td>
<td>Instructor</td>
<td>4</td>
</tr>
<tr>
<td>Professor Susan</td>
<td>Assistant</td>
<td>6</td>
</tr>
<tr>
<td>Professor Diane</td>
<td>Assistant</td>
<td>6</td>
</tr>
<tr>
<td>Instructor Rene</td>
<td>Instructor</td>
<td>4</td>
</tr>
<tr>
<td>Professor Mary</td>
<td>Associate</td>
<td>8</td>
</tr>
<tr>
<td>Professor Lexie</td>
<td>Associate</td>
<td>7</td>
</tr>
<tr>
<td>Professor Bob</td>
<td>Associate</td>
<td>7</td>
</tr>
<tr>
<td>Professor Kate</td>
<td>Associate</td>
<td>8</td>
</tr>
<tr>
<td>Professor Leah</td>
<td>Associate</td>
<td>8</td>
</tr>
</tbody>
</table>
Implementation of the Problem-Based Learning Process

The PBL group in the study participated in the implementation of a common problem-based learning scenario, *The Dog Ate My Homework* (PBL@ UD, 2011) (appendix A), in the content methods courses required for teacher education majors at each of the seven off-campus sites. The scenario in *The Dog Ate My Homework* (PBL@ UD, 2011) included an authentic problem in which the pre-service teachers were required to explore numerous aspects of the debate over homework policies. The pre-service teachers then had to create a homework policy for a fictitious school. The professors involved in this study attended a PBL training session (basic introduction, example PBL cases and end products) during the spring of 2011, and each of them implemented the common PBL scenario into their content courses during fall semester 2011.

The constructivist PBL method involved student-centered learning in which students worked in small groups (using tools such as research) to find multi-solutions to problems that focused on authentic teaching situations. The groups were given one section of the problem to analyze, followed by other sections of information given at intervals. The professors, in contrast to traditional instruction such as lecture, did not use direct teaching and acted only as a facilitator for the class. For *The Dog Ate My Homework* (PBL@ UD, 2011) scenario, each of the professors randomly placed their students into groups ranging from four to six students per group. The professors coordinated the PBL scenario in varying ways. For example, three of the professors at one site had their students complete the scenario in one six-hour block of time. Three
professors spread the PBL process over a two-week period. During the first week, the problem was introduced and the project was assigned to the groups. The students, outside of class time, completed the required research. Then group discussions and presentations were conducted during the second week. Two professors utilized the PBL process over a three-week period in which the groups were introduced to the problem, projects were assigned, and research expectations were given during the first week. During the second week, the groups met outside class time to analyze research and work on the project. Group discussions and presentations were conducted during week three. In addition, one professor extended the PBL procedure over a four-week period in which the problem was launched during the first week followed by group work outside of class time. The groups gave final presentations during week four.

**Quantitative Methods**

The exam identified as the dependent measure in this current study, the *Principles of Learning and Teaching* (PLT), is required for all K-6 initial licensure candidates in the state of Tennessee. The *No Child Left Behind Act of 2001* requires schools to hire highly qualified teachers, defined by passing state licensure tests. The process of licensing teachers in Tennessee requires the successful completion of approved programs of study and completion of identified state licensing exams. The *Praxis II Series* published by Educational Testing Service is currently accepted as the state-licensing exam required in Tennessee. The PLT is a two-hour exam consisting of 12 short-answer questions and 24 multiple-choice questions. Four case histories are presented, each followed by three short-answer questions. These short-answer questions make up 66% of the total score.
These case studies align themselves with the use of The PBL cases. That is, authentic scenarios are given, followed by a section for a student’s written response offering strategies for solving the situation given in each scenario. The other 34% of the total score comes from multiple-choice questions. All questions on the PLT exam assess pre-service teachers’ competencies in professionalism, communication techniques, instruction and assessment, and students as learners (Educational Testing Service, 2011).

Reliability and validity of the PLT are detailed by Educational Testing Service (ETS). Two independent scorers who collaborate on assessment scores grade each test, which establishes inter-rater reliability using the Spearman-Brown formula (Educational Testing Service, 2011). The standard error of measurement is computed for the raw score as well as the scaled score. In terms of reliability, ETS states, “the reliability of a set of test scores can not be assessed directly, but only estimated” after it was established that true scores can never be known (Educational Testing Service, 2008, p. 36). Reliability is estimated using the Kuder and Richardson Formula 20. Validity for the Praxis II series of tests is dependent upon content-related evidence. Several measures are taken to establish validity, including “the connection or alignment between the content of the test and the knowledge and/or skills judged important for entry-level practice” (Educational Testing Service, 2008, p. 3).

Adding to the validity of the tests is the evidence-centered design process (ECD) through which the test items are developed. There are three stages that test items follow during the ECD process: “a) defining the claims to be made, b) defining the evidence to
be collected, and c) designing the tasks to be administered” (Educational Testing Service, 2008b, p. 11).

The *Praxis II Principles of Learning and Teaching* exam was taken by the comparison group of non-PBL participants at the end of their content methods courses (January or March, 2011). The PBL group of students took the *Praxis II Principles of Learning and Teaching* exam in the spring of 2012. These two sets of PLT scores were compared in order to look for a significant difference in the effects of PBL vs. non-PBL instructional methods in teacher education content methods courses.

The two covariates, ACT and GPA, were also examined for reliability and validity. According to the ACT Technical Manual (2007) the ACT tests are devised to assess high school students’ problem-solving skills and proficiency in specific branches of study. The methods used in the creation of current ACT exams include a comprehensive review procedure in which each exam item is scrutinized at least sixteen times. In order to be deemed an authentic assessment of curricula that is currently in high schools and universities, explicit test requirements for the ACT have been established. Several studies that corroborate the validity of the ACT are given in the 2007 ACT Technical Manual.

High school GPA is often viewed as a less reliable indicator of student achievement. Yet when compared to standardized test scores, high school GPA is derived from continual examples of a student’s performance over a period of time and in a mixture of educational backdrops (Geiser & Santelices, 2007). These researchers go on to support the validity of GPA by stating “high-school grade point average is consistently
the best predictor not only of freshman grades in college, the outcome indicator most often employed in predictive-validity studies, but of four-year college outcomes as well” (Geiser & Santelices, 2007, p. 1).

**Quantitative data collection and procedures.** An Institutional Review Board (IRB) application (Appendix F) was completed and approved for this study by the participating institution in November 2011. Permission to collect student PLT scores was granted by the chairperson in the Department of Curriculum and Instruction in which all students were enrolled. IRB approval (Appendix F) was also requested and received from the researcher’s degree-issuing university. The quantitative data collection involved a variety of data. The pre-service teachers received their individual scores for the PLT within four weeks of testing. The two parts of the PLT scores, multiple choice and constructed response, were released to the students a week apart. The pre-service teachers who took the PLT exam in mid-January 2012, received their scores in late February, and the pre-service teachers who took the PLT in mid-March 2012, obtained their scores in early May. The scores were also reported to the university at which the pre-service teachers are enrolled. Students’ PLT scores from the 2010-2011 cohorts were already in the database at the main university. Both sets of PLT scores, as well as ACT and GPA, were made available through the Director of Teacher Education at the same university. After the student data were collected, any personally identifiable information present in the data was eliminated prior to inclusion in the study. Student data were then organized by variables in a spreadsheet to prepare for analysis. Column one in the spreadsheet
included a participant identification number randomly assigned for organizational purposes in this study. Column two contained the dependent variable, PLT scores. The third column represented the independent variable, delivery method, with the PBL participation identified as 1 and students who did not participate in PBL identified as a 0. Next, each student’s cohort was identified by site (1 = Site 1; 2 = Site 2; 3 = Site 3; 4 = Site 4; 5 = Site 5; 6 = Site 6; 7 = Site 7). Finally, columns five and six represented the covariates of ACT and GPA.

While analysis of this data was ongoing, the scores were kept in the researcher’s office under lock and key. The organized data were also kept on the researcher’s password-protected computer. For the purpose of this study, only the summative data were disclosed.

**Hypothesis.** The quantitative methodology in this study calls for a hypothesis, in close relation to the research questions, to be investigated through statistical analysis. One hypothesis drove the quantitative investigation:

Hypothesis1: Differences will exist in the *Praxis II Principle of Teaching and Learning* exam scores between pre-service teachers taught using PBL in content methods courses and the *Praxis II Principle of Teaching and Learning* scores of pre-service teachers using non-PBL in content methods courses, after adjusting for ability.

**Quantitative Analysis of Data.** For the quantitative portion of the study, the primary independent variable was the method of teaching: the PBL method versus the non-PBL (traditional) learning method. The dependent variable was the participants’ scores on the *Praxis II Principal of Learning and Teaching* exam. To help adjust for
ability between the two groups, each student’s ACT score and GPA was used as a covariate. Data was screened prior to analysis to look for missing cases, outliers, and to establish normality. The program SPSS was utilized to run an analysis of covariance (ANCOVA) to identify possible differences between the groups. The significance level was set at $p \leq .05$. The main effect of method of teaching was examined and interpreted on the results of the ANCOVA.

**Qualitative Methods**

The qualitative method that was used for this study included interviews of eight teacher education professors who teach at the seven off-campus sites. Although educational reform movements are focusing on teacher education programs now more than ever, teacher education professors are rarely showcased in research. The interviews included in this study were an attempt to give authentic representation of views, experiences, and perceptions of professors involved in PBL. In order to add clarity and support to the findings, the researcher recorded field notes into a journal during each interview. Reflections from 43 participating pre-service teachers also were added to ensure genuine views of the PBL process in college courses.

The eight professors were interviewed and digitally recorded. The interviews were arranged at the convenience of each professor. The interview questions focused on an overall perspective of the professors including apprehensions, steps of implementation, student reactions, limitations, and effectiveness of PBL in content courses. The information found in the qualitative data was coded and then framed in theme tables, descriptive data, and direct quotes from the participating professors. The
qualitative findings did not verify or revoke statistical validity nor did they have any impact on the quantitative statistical data analysis. The qualitative analysis did, however, provide a richer picture of the intricacies involved in the implementation of PBL.

**Qualitative research questions.** The qualitative methodology in this study calls for the investigation of professors’ insights through inductive analysis. Two questions drove the qualitative investigation:

1. How do teacher education professors describe the experience as they implemented PBL in their college-level classrooms?
   1a. What challenges and/or pedagogical concerns did the teacher education professors face as they implemented PBL in their college-level classrooms?
   1b. What positive experiences and outcomes did the teacher education professors encounter as they implemented PBL in their college-level classrooms?

2. What do the teacher education professors consider essential elements of a successful PBL model?

**Qualitative data collection and procedures.** As stated earlier, an Institutional Review Board (IRB) application was completed and approved for this study by the participating institution in November 2011. The professors were initially contacted through e-mail at the beginning of the 2011 fall semester. The e-mail contained a summary of the intended research followed by a request for participation (Appendix D). The professor-participants were informed of the process and premise behind the study. Participation in this study was voluntary and anonymous. During the first week in
November 2011, consent forms (Appendix E) were given in person to the professors who volunteered to participate in the study. The consent forms were signed and dated by each professor, and these forms were collected and kept on file by the researcher.

**Triangulation.** In order to ensure more accurate and credible results of qualitative data, triangulation is often used. Triangulation involves a careful inspection of collected data from different sources. The goal of triangulation is a result in which each method of measurement merges into common answers. However, complete commonality may not always occur in qualitative data (Oliver-Hoyo & Allen, 2006). The qualitative data collected for this study supplied the information needed for the researcher to uncover patterns in professor and student perceptions of the PBL process. There were three data sources for the qualitative component of this study. The primary source of data was digital recordings of interviews with each participating professor. Another data source included field notes taken during individual interviews. The third source of data came from the perspective of the pre-service teacher participants. The professors were asked (not mandated) to have students write reflections about the PBL process in general. These reflections could be written throughout the entire activity, or at the end of the PBL. Since the desire for student reflections was a request, a rather small number (43) of student reflections were collected by participating professors and e-mailed to the researcher. No names or identifying items were included in the student reflections.

**Procedures.** A total of nine professors (including the researcher) volunteered for the qualitative element of this study (see Table 1). Each participating professor was given a pseudonym and identified by site number. These particular professors were selected
because their students received problem-based learning (PBL) methodology in their content courses, and the professors agreed to implement a common PBL during fall semester 2011.

**Interviews and student reflections.** Interviews were scheduled at the convenience of each participating professor. The interviews occurred over a time period of eight weeks during spring semester 2012. In addition, the participant interviews took place in varied locations. Three of the interviews were carried out on the main campus of the teacher education university (one interview was conducted simultaneously with three professors). Two of the interviews were conducted via telephone, and one interview was administered at a restaurant. Each interview was digitally recorded on an iPad and lasted between 25 to 45 minutes. Each professor responded to a common series of 19 open-ended questions that focused on overall perspectives of the professors including apprehension, steps of implementation, student reaction, limitations and effectiveness of PBL and its use in teacher education courses (see Appendix C). During each digitally recorded interview, the researcher documented field notes into a journal. These field notes included details such as physical environment, descriptions of the participants, steps and variations of the steps that occurred in each interview. This documentation became invaluable in the analysis of data because the notes supported the themes found throughout the qualitative process.

The participating professors collected a total of 43 student reflections and e-mailed them to the researcher. The students were assigned a number (1-43) and no other identifying information was included in the reflections.
**Qualitative analysis of data.** The qualitative data were explored using inductive analysis. First, each digitally recorded interview was transcribed. Interview transcripts were organized, coded, and then categorized to highlight themes found throughout the data. According to Bogdan and Biklen (2007) interviewing (as opposed to observing) participants is a better method for qualitative research because legitimate ideas and insights will surface when participants are asked for their input about the elements of the research. LeCompte (2000) denoted further support for the use of inductive analysis when she claimed that diligent analysis, grounded in reputable theory and relevant research questions can generate meaningful results for the participants. LeCompte’s (2000) model of inductive analysis was used following these steps: 1) Tidying up which requires the researcher to navigate through initial data and make assessments and adjustments by filing, labeling, and copying; 2) Finding items by screening data repeatedly in order to establish initial items relevant to the research questions; 3) Creating stable sets of items that involves comparing and contrasting these items so they can be assembled into clear-cut groups; 4) Creating patterns that resembles putting puzzle pieces together so that the big picture begins to emerge for the researcher; 5) Assembling structures in which the patterns are grouped in various ways (graphics such as flow charts, diagrams, or causal maps) that allow the researcher to see the “overall description of the program or problem being studied” (p. 8).

The researcher listened to each digital recording in its entirety on the day following the individual interview. The first step of LeCompte’s (2000) model of inductive analysis (tidying up) was then followed in which the data was transcribed and
labeled. The recordings were replayed (and paused) while the researcher transcribed (word processed) each professor’s answers into a question template. The transcription included each interview verbatim. After each transcript was completely word processed, relevant information from the field notes was added throughout the text.

Step two in the inductive analysis model (LeCompte, 2000) was then conducted as each transcript was screened repeatedly and the researcher highlighted (blue) initial items that were relevant to the qualitative research questions. The next stage of inductive analysis consisted of comparing and contrasting the highlighted items found in each transcript. The common items were then highlighted in a different color (yellow). In order to complete the fourth step of LeCompte’s (2000) model, the common items were copied and pasted under corresponding questions in a new question template. It was during this process that patterns and common perspectives in the data began to emerge for the researcher. These patterns were then assembled into a matrix that allowed an overall view of professors’ common attitudes and perceptions. Four common themes emerged from the participating professors’ interviews. These themes are shown in Table 2.
Table 2

Professor Interview Themes

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concerns about initial Implementation of PBL</td>
<td>Benefits of PBL in content courses</td>
<td>Limitations of PBL in content courses</td>
<td>Elements of effective PBL models</td>
</tr>
<tr>
<td>Examples</td>
<td>Examples</td>
<td>Examples</td>
<td>Examples</td>
</tr>
<tr>
<td>New teaching method</td>
<td>Authentic real-world tasks</td>
<td>Time factor</td>
<td>Authentic problems/scenarios</td>
</tr>
<tr>
<td>Uncertainty of teacher role</td>
<td>Students began to think like teachers</td>
<td>Group Work</td>
<td>Professor involvement in PBL creation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uncertainty of amount of content included</td>
<td></td>
</tr>
</tbody>
</table>

Inductive analysis was also conducted on 43 pre-service teachers’ reflections on the PBL process in general. LeCompte’s (2000) five-step inductive analysis process was followed in the same manner as the analysis completed for participating professor interviews. The themes that surfaced from the pre-service teachers’ reflections fell into two distinct categories: benefits and limitations of the PBL process.

Summary

The mixed-method study incorporated quantitative analysis to examine differences in state licensure exam scores between pre-service teachers edified through PBL methodology and pre-service teachers taught through non-PBL pedagogy. The perspectives of the instructors and pre-service teachers who took part in the PBL instruction were investigated using qualitative measures, and the findings shed light on potential value and/or barriers of implementing a non-traditional teaching method such as PBL into their teacher education content courses. Overall, the research augments the limited body of knowledge about PBL and its role in teacher education settings.