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Investigating Traditional Instruction and Problem-Based Learning at the Elementary Level

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INVESTIGATING TRADITIONAL INSTRUCTION AND PROBLEM-BASED
LEARNING AT THE ELEMENTARY LEVEL

By

Ann Wiley Scott

A Dissertation
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
in Education
in the Department of Instructional Systems,
Leadership, and Workforce Development

Mississippi State, Mississippi

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2005

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LEARNING AT THE ELEMENTARY LEVEL

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Pages in Study: 133

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The purpose of this study was to determine if Problem-Based Learning (PBL) is as effective an instructional method at the elementary level as traditional instruction in learning content. This study also is a contribution to the literature on PBL in the elementary classroom. The research design was quasi-experimental with a non-equivalent control group. A pilot study was conducted in science classes prior to the commencement of the research project in social studies. Eighty-eight students participated in the two studies. The control groups received instruction in a traditional format, and the experimental groups received instruction through the use of PBL. The research question dealt with whether or not PBL was as effective an instruction method as traditional instruction in student achievement. *T*-tests were run at the conclusion of each study to compare the means of posttest scores and presentation assessment scores. Analysis of Variance (ANOVA) was used to determine if the differences in means were because of treatment effect or by chance. Analysis of Covariance (ANCOVA) was used to determine if prior knowledge had an impact on the student achievement scores.

After the science data were collected and analyzed, the researcher determined that there was a statistically significant difference in the student achievement scores between those involved in the PBL class and those taught traditionally on both the posttest scores and the group presentation scores. Students enrolled in the traditional class scored significantly higher than those enrolled in the PBL class. The researcher noted, however, that both groups made gains in achievement.

Assumptions for normality and homogeneity for t-test, ANOVA and ANCOVA were not met for the social studies classes. Transformation of the data took place using arcsine because of a negative skew of the data. After the social studies data were collected and analyzed, the researcher determined that there was no statistically significant difference in the posttest scores for the PBL and traditional classes. The group presentation grades produced conflicting results. Transformed data indicated a significant difference in student achievement while non-transformed data indicated that there was no statistically significant difference in the scores. The researcher noted that both groups made gains in achievement.

DEDICATION

I would like to dedicate this research to the honor and glory of God and to my parents, Jack and Eleanor Scott, and my siblings, Ed and Charlotte, Caroline, and Tom and Holly. Your words of encouragement and your prayers of support over the years are what enabled me to complete this goal.

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TABLE OF CONTENTS

	Page
DEDICATION	ii
ACKNOWLEDGEMENTS	iii
LIST OF TABLES	viii
LIST OF FIGURES	x
CHAPTER	
I. INTRODUCTION	1
Statement of the Problem.....	5
Purpose.....	7
Justification of the Study	7
Research Question	9
Definition of Terms.....	9
Delimitations.....	10
II. REVIEW OF RELATED LITERATURE	12
Process of Learning.....	13
Neuroscience and Brain Research	13
Neuroscience.....	13
Brain Research.....	14
Hierarchy of Needs, Learning Styles and Multiple Intelligences	14
Hierarchy of Needs	15
Learning Styles	16
Multiple Intelligences	16

CHAPTER	Page
Cognitive Development	17
Piaget.....	18
Vygotsky.....	18
Bloom.....	19
Summary of Process of Learning Research.....	20
Traditional Instruction	21
Goal of Traditional Instruction	22
Characteristics of Traditional Classrooms	22
Teacher-Centered.....	23
Role of Teachers	23
Role of Students.....	24
Testing.....	24
Delivery Methods.....	25
20 th Century Challenge	25
Challenges to 20 th Century Research.....	26
Skills for the 21 st Century	28
Skills Identified.....	28
Use of Technology.....	29
Problem-Based Learning	31
Role of the Problem	31
Importance of Prior Knowledge.....	31
Role of Teachers	32
Role of Students.....	33
Problem-Based Learning and 21 st Century Skills.....	34
Challenges for Problem-Based Learning.....	36
Problem-Based Learning in Higher Education.....	37
Summary of Review of Literature	40
III. METHODOLOGY	44
Research Design.....	44
Participants.....	45
Pilot Study – Science Case	46
Instrumentation	46
Reliability and Validity.....	47
Procedures.....	49
Control Group (Traditional).....	51
Experimental Group (Problem-Based Learning).....	52
Data Analysis	53
Research Study – Social Studies Case	54
Instrumentation	55

CHAPTER	Page
Reliability and Validity	55
Procedures	58
Control Group (Traditional)	58
Experimental Group (Problem-Based Learning)	59
Data Analysis	60
 IV. RESULTS	 62
Findings of the Pilot Study	63
Descriptive Data	63
Test Score Analysis	64
Summary of Pilot Study	71
Findings of the Research Project	72
Descriptive Data	72
Test Score Analysis	73
Summary of the Research Project	81
 V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS....	 82
Summary	82
Conclusions	83
Pilot Study – Science Case	84
Research Study – Social Studies Case	84
Summary of Conclusions	86
Recommendations for Practice	88
Recommendations for Future Research	88
 REFERENCES	 90
 APPENDIX	 98
A Presentation Rubric and Definitions	98
B Science Case	101
C Permission from Mississippi State University Institutional Board....	103
D Parental Consent and Minor Assent Forms	106

APPENDIX		Page
E	Pilot Study – Traditional Lesson Plans	111
F	Presentation Guidelines	113
G	Pilot Study – Problem-Based Learning Lesson Plans.....	115
H	Science – PBL Worksheet	117
I	Social Studies Case	119
J	Parental Consent and Minor Assent Forms	121
K	Lesson Plans – Traditional	126
L	Lesson Plans – Problem-Based Learning	129
M	Problem-Based Learning Worksheet	132

LIST OF TABLES

TABLE		Page
1	Demographics of Students by Instructional Method	64
2	Independent-Measures <i>t</i> -test results – pretest, posttest, group presentation..	65
3	Student Achievement <i>t</i> -test Descriptives – pretest, posttest, group presentation	65
4	Descriptives for Instructional Methods.....	67
5	Analysis of Variance for Instructional Methods.....	67
6	Analysis of Covariance – Posttest.....	69
7	Descriptives for Instructional Methods.....	69
8	Analysis of Covariance – Group Presentations	70
9	Demographics of Students by Instructional Method	73
10	Independent-Measures <i>t</i> -test results after transformation – pretest, posttest, group presentation	74
11	Student Achievement Descriptives after transformation – pretest, posttest, group presentation	75
12	Student Achievement Descriptives non-transformed data (original) – pretest, posttest, group presentation.....	76
13	Descriptives for Instructional Methods.....	77
14	Analysis of Variance for Instructional Methods.....	78

TABLE	Page
15 Descriptives for Instructional Methods non-transformed data (original)	78
16 Analysis of Variance for Instructional Methods non-transformed data (original)	79

LIST OF FIGURES

FIGURE		Page
1	Maslow's Hierarchy of Needs Diagram	15
2	Bloom's Taxonomy Diagram	19
3	Quasi-Experimental Nonequivalent Control Group Design	45

CHAPTER I

INTRODUCTION

“Why do we need to know this?” – is a question that has resounded throughout classrooms (Lambros, 2002). As students search for justification for learning something that does not seem necessary to them, teachers struggle with helping them to understand that the new knowledge gained will be useful in the future even if they cannot see its relevance to their current situation. The educational process in the early 20th century was designed to accommodate the industrial age and the manufacturing of goods. Teachers were encouraged to educate the masses in an effort to produce workers who could take their place in the workforce as productive employees as quickly and as efficiently as possible.

As the 20th century progressed, however, new efforts were made to gain an understanding of the processes of learning and to take into account the individual differences found in learners. The National Research Council (2000) has identified some of the findings from brain research to understand how it functions, how people process new knowledge, and how people incorporate new knowledge. Salpeter (2003) identified several skills that people will need in the new century. Included in this list was the ability to think critically, apply knowledge to new situations, analyze data, work collaboratively,

and learn to solve problems and make decisions. Delisle (1997) also identified thinking, researching and problem solving as areas of development that need to be a part of the 21st century worker.

Yet as the 20th century ended, in spite of all that had been learned about the learning process, Tapscott (1998) found that teachers continued to teach the way in which they were taught. They continued to use broadcast media methods that included the use of the textbook, the lecture method, and homework as a centralized method of providing information to the students. Teachers continued to be the source of information and authority on what should be learned. Despite recommendations, educational classroom designs have predominantly remained the same as in the early 20th century (Ordonez & Ramier, 2003).

Chall (2000), whose experiences in education spanned the last half of the 20th century, reviewed the educational practices of the 20th century and found traditional education to be more effective in producing learners with high academic achievement. Her study in education found traditional education to be more focused on the individual learner with the goal of acquiring knowledge rather than on student-centered education. The most positive effects on learning come when the teacher directs the learning by letting the students know what is to be learned, how it is to be learned; and when the students concentrate on the tasks at hand with the teacher intervening when errors occur and giving direction as to how to correct the errors of understanding. Traditionally instructed students gained knowledge, values, and skills that had been deemed important and had produced successful learners in the past. Student-centered instructional methods

presented problems for children from low-income families and those who were low achievers. Henson (2003) described traditional education as being teacher-centered, passive, and competitive for the learner. Many educators considered teacher-centered instruction as having shared responsibility between teacher and learner for the acquisition of knowledge (Chall, 2000).

Ordonez and Ramier (2003) recognized that there is a disconnect between the classroom and the real world in which the students function. Students often have not seen connections between the instruction in the classroom and what they will be expected to do to make a living (The Secretary's Commission on Achieving Necessary Skills [SCANS], 1991). Skills and knowledge taught in the classroom appear to be different from the skills and knowledge that will be needed in the communities and workplaces of the 21st century (Partnership for 21st Century Skills, n.d.). A wide gap has developed between the skills acquired in schools and the skills needed to succeed in the global, technological workplaces of the 21st century (Partnership for 21st Century Skills, 2005).

Workers of the future will most likely be faced with multiple careers during their lifetime. They will need to be able to adapt to the emerging technologies and learning that will be necessary to be successful in their work. Schools have an obligation to provide students with opportunities not only to learn but also to strengthen the process of learning so that they are able to prepare for their life's work. Learners of the 21st century, who will probably have multiple careers, will face retraining at their job or new training opportunities as they advance through life. As students prepare for a life of perpetual

learning with these multiple careers, educators need to prepare them to become lifelong learners (Ordonez and Ramier, 2003).

The Secretary's Commission on Achieving Necessary Skills (1991) reported that more than one-half of students graduating from high school did not have the skills or foundation to find and hold a good job. The demands of the business world have changed. North Central Regional Education Laboratory (NCREL) and the Metiri Group (2003) explained that the goal of education should not be merely to provide skills that enable people to live but should provide them with foundations upon which they can build and live full lives. World globalization and the constantly changing world of technology will require a shift in educational instruction to provide learners with the skills which will enable them to be successful in the 21st century (NCREL, 2003). Just as the fields of medicine and law require their employees to keep abreast of current changes, educators must also be aware of current practices that will allow students optimal opportunities for learning (NCREL, 2003).

Approximately 30 years ago, a teaching technique providing an alternative route to conventional education surfaced (Barrows, 2002). This technique, called Problem-Based Learning (PBL), provided the opportunities that Salpeter (2003) and Delisle (1997) had identified as needed by today's learners. Rooted in the work of John Dewey (Delisle, 1997; Lambros, 2002) and complementing the work done by Jean Piaget and Leo Vygotsky with active learning (National Research Council, 2000), Howard Barrows developed PBL to provide opportunities for student learners to take an active role in their medical school training (Delisle, 1997). His goal was to present a problem case to the

students that challenged them to research, to develop solutions, and to solve the problem given to them (Delisle, 1997). Problem-Based Learning progressed from the medical schools in which it originated to other institutes of higher learning in the 1990's (Duch, Groh, & Allen, 2001).

Problem-Based Learning has begun to find a home now in the K-12 schools, as teachers attempt to provide students with opportunities to enhance critical thinking and reasoning skills and promote higher achievement standards (Delisle, 1997). Kain (2003) has indicated that educators have discovered the benefit that PBL has provided in helping to make learners better thinkers. Yet, he recognized that the research on the benefits of this method is incomplete and still emerging. Kain (2003) reported findings that show that PBL is as effective as traditional education. He further indicated that research demonstrated that greater understanding also is encouraged through the use of PBL. Torp and Sage (1998) found that well-implemented problems provide opportunities for gaining much academic content. Learning to identify key issues, deriving possible solutions, researching those solutions, and determining final answers to the problems will provide learners with skills that will guide them throughout their lives (Torp & Sage, 1998).

Statement of the Problem

While research has been conducted on PBL in a variety of educational fields (Miller, 2003; Reeves & Francis, 2002; Reynolds, 2003), the majority of research has been conducted in the medical field. Some work also has been done with graduate students (Yang, 2001), with achievement levels of students (Liu, 2004), with at-risk

students (Cerezo, 2004), and in counseling with student bullies (Hall, 2004). However, no studies were found that show research had been done with elementary students.

Problem-Based Learning has been put forth as a method of instruction that can encourage active learning and promote skills that will enable a person to be successful in the 21st century (Torp & Sage, 1998). The work of Dewey, Piaget, and Vygotsky throughout the 20th century provided a platform for successful PBL experiences in education (National Research Council, 2000). If, as research has indicated, PBL has been successfully implemented in areas of higher education, research needs to be conducted at the K-12 level to provide information as to whether or not PBL can encourage successful learning at all academic levels. Failure to provide learning opportunities could hinder students from receiving the best education possible (Reagan, 2000). Building on the work done by Dewey, Piaget, and Vygotsky to enhance the learning experience and provide building blocks for the future, PBL must be investigated as a possible method of instruction for students of all ages.

Many books and articles on the how-to process are available, but no studies were identified as experimenting with the use of PBL at the elementary school level. This study provides research on the PBL method of instruction at the elementary level. Student assessment scores of PBL students will be compared to the scores of students receiving traditional instruction. The outcome has provided information seeking to determine whether students could successfully use PBL at the elementary level to gain content learning and encourage the process of active learning.

Purpose

The purpose of this study was to determine if Problem-Based Learning is as effective an instructional method at the elementary level as traditional instruction in learning content. A pilot study with two science classes was implemented prior to the research project with the social studies classes.

Justification of the Study

Traditional education has provided leaders in the most technologically advanced country with the most educated citizens including some of the most respected leaders of the world (Weinig, 2000). Studies have shown that traditional instruction has provided opportunities for students to reach higher levels of academic success than in non-traditional classrooms (Cuban, 1984; Kennedy, 1978; Stallings, 1975). Research of the 20th century has given a better understanding of the brain and how it functions, the different needs of learners, and provided theories about learning to aid the students as they move through school gaining knowledge (National Research Council, 2000). Although traditional education has been profitable for many, it may not meet the needs of all students.

The CEO Forum (2001) reported that the 21st century would require workers who can work in a global digital economy. Workers will have to compete in a global environment in technically skilled jobs. Schools that have continued to reflect the past cannot prepare students to thrive in the 21st century digital age. Many schools have trailed behind in offering students opportunities to become workers of the future engaged in

global communications and using technology to provide opportunities for further learning (National Education Technology Plan, 2004).

Skills needed in the workplace have changed. Twenty-first century workers will require more than content knowledge (Partnership for 21st Century, 2005). The North Central Regional Educational Laboratory and the Metiri Group (2003) have identified some of the new skills needed for the 21st century worker as multicultural awareness, global awareness, high order thinking skills, interpersonal skills, adaptability, curiosity, effective communication, and collaborative work. Workers of the future will have to be able to acquire new knowledge and skills, connect those with their prior knowledge, analyze and synthesize the material and make decisions, as well as work collaboratively with others to use the information gained (Partnership for 21st Century, 2005). Studies reflecting the inclusion of the learning of these skills in elementary education are missing.

The purpose of PBL is to encourage the content learning of students as well as to involve them in learning a process that will serve them throughout their lives. The Problem-Based Learning process aids students in identifying information needed, figuring out where information is needed, helping them to organize the information and to communicate with others both in the building process of learning and in sharing what they have learned through the process (Duch et al., 2001). Identifying instructional techniques that provide opportunities for students to become lifelong learners and, at the same time, encourage them to develop skills that will aid them in this goal of learning should be a part of the education system. Studies have shown that PBL has been as successful as traditional instruction at levels of higher education (Mergendoller,

Bellisimo, & Maxwell, 2001; Miller, 2003; Reeves & Francis, 2002;). This study provides research that will help determine whether or not PBL is as effective an instructional method at the elementary level as traditional instruction in learning content.

Research Question

This study will focus on whether PBL is as effective an instructional method in fifth-grade social studies classes as traditional instruction. This study addresses the following research question:

1. Is Problem-Based Learning as effective an instructional method at the elementary level as traditional instruction in learning content?

Definition of Terms

For the purpose of this study, the following definitions were used in this study:

1. Traditional instruction – an instructional method that provides an education that is focused on acquisition of information and skills; adding to the knowledge base that already exists through the use of drill and practice with testing (Chall, 2000).
2. Teacher-centered – an instructional environment where the teacher controls what is learned, when it is learned and how it is learned (Cuban, 1984); an instructional environment where the students and teachers share responsibility for the learning (Chall, 2000).
3. Problem-Based Learning – an instructional method whereby the learners are challenged to solve a real-world problem. Working in teams, the students will use prior

knowledge and inquiry to structure learning as they seek to solve the problem that they have been given (Duch et al., 2001).

4. Student-centered – learning in which students have a substantial role to play in deciding what is learned and how it is learned. Students help choose and organize the content (Cuban, 1984).

5. Active learning – active participation of the students in the process of learning in which they will take a role in determining what will be learned through actively seeking knowledge (National Research Council, 2000).

6. Passive learning – passive participation of the students in the process of learning in which the students take in the instruction given by the teacher (Duch et al., 2001)

Delimitations

This study was limited to an urban, private, religious school in the Southeastern United States. Research was conducted with two 5th-grade science classes during the pilot study and two 5th-grade social studies classes during the research study. The population of the fifth grade was 104 students. The sample was 88 students who participated in one of the two studies; 44 students participated in each group. The classes were self-contained instructional units. Students were randomly assigned to the classrooms through implementation of a computer program at the beginning of the school year. An attempt to distribute students equally according to gender in the classrooms was made at the beginning of the school year when initially assigning students to the classrooms. No effort was made by the school to identify student achievement ability when assigning students to the classes. The school does not make classroom assignments

based on student achievement abilities. The classes, therefore, were heterogeneously grouped for ability.

CHAPTER II

REVIEW OF RELATED LITERATURE

Findings have revealed that focusing on students' interests and the real-life problems they may face can provide a vehicle to learning (Kain, 2003). Learners of this millennium will be faced with multiple careers that will require training and retraining throughout their lifetime (Ordonez & Ramier, 2003). The Partnership for 21st Century Skills (n.d.) has identified one problem in schools as being the disconnect between everyday life and how students have typically been taught. Scientific research of the last century has provided a better understanding of the process of learning and how to engage students in the learning process effectively. Many skills identified by Salpeter (2003) that will enable students to think critically, apply knowledge to a new situation, and analyze data through solving problems and decision-making have been incorporated by the PBL process. This chapter will focus on literature about gains made in the 20th century concerning the understanding of the process of learning, traditional instruction, 21st century skills, and Problem-Based Learning.

Process of Learning

The National Research Council (2000) identified cognitive research as an area of research prevalent in the last century. Research about the brain and about how learning actually occurs has dominated the field of science and, in particular, educational psychology. The science of learning has become one of great interest to educators because of the implementation of the findings relevant to the classroom. The foundation for new learning should be built on the recognition of, and the incorporation of, prior knowledge with new knowledge gained. Helping students increase understanding is an important basis for true learning.

Neuroscience and Brain Research

Much has been learned about the brain and the way it functions in the 20th century. This section summarizes some of those findings.

Neuroscience

The National Research Council (2000) has summarized the research work of the last half of the 20th century. Research has been conducted and an attempt has been made to understand how the brain works (National Research Council, 2000). The brain continues to change over the course of a person's life. Neurons in the brain contain branches called dendrites. As the brain is used the dendrites strengthen, thus enabling connections of the brain to be stronger. These stronger connections aid learners in the process of learning as well as the retention of what is learned. Understanding the working

of the brain encourages educators to provide an environment that will make these connections stronger.

Brain Research

Research on the brain itself indicated that there is a natural learning process whereby the learner identifies new information, synthesizes its implications with prior knowledge, and produces new learning (National Research Council, 2000). Furthermore, a student's environment is an important factor in the learning ability and in the building of strong connections for understanding and retention (National Research Council, 2000).

Research has also been conducted in the areas of right brain/left brain thinking. Scientists have found that the two sides of the brain function differently. Through activities geared to stimulate the brain, students must be challenged to think with both sides of their brain to further their understanding, and instructors must recognize that all students do not learn the same way and must provide for multiple learning needs (National Research Council, 2000).

Hierarchy of Needs, Learning Styles, and Multiple Intelligences

The 20th century educational psychologists and scientists provided many theories about learners and how to provide an optimal education. Recognizing the differences in learners and accommodating them provides an opportunity for the learners to be successful in school.

Hierarchy of Needs

Abraham Maslow, an American psychologist, created a hierarchy of needs, which is centered on the importance of meeting the basic needs of people. His theory suggests that the basic needs must be met before learning can occur (Jones, 2004). His theory is based upon the idea that people strive to do the best they can, but if certain basic needs have not been met, full potential is not always possible (Jones, 2004) (See Figure 1).

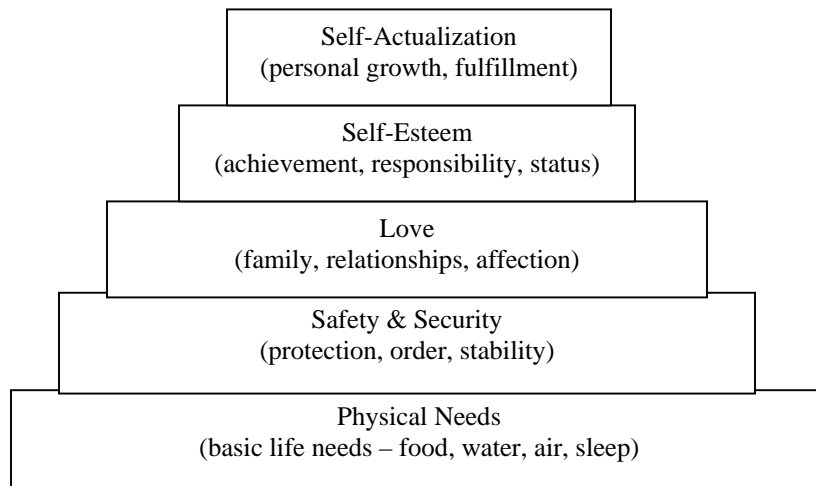


Figure 1: Maslow's Hierarchy of Needs Diagram

Maslow's study of people led him to create his hierarchy of needs list. His needs list included physical needs first—those of food, water, and sleep. Safety and security is the second level, and making the child feel that he/she is loved and belongs is the third level of needs. Addressing the child's need for esteem and self-actualization round out the hierarchy identified by Maslow (McKeachie, 1999). Focusing on and meeting these first four needs of a person will allow the person to reach a higher level of success (Jones, 2004).

Learning Styles

The National Research Council (2000) identified learning styles that should be included in the concept of educating a child. Since individuals perceive information differently and process it differently, educators must be prepared to recognize the differences and provide learning opportunities for children with many different learning styles. Some students may be concrete learners who incorporate new knowledge through experiencing the information, while others may be abstract learners capable of learning through observing. Some students require an active process to use new information immediately, while others may reflect upon the learning before implementing it.

Multiple Intelligences

Howard Gardner, an American psychologist, has researched and described a theory of multiple intelligences (Eisner, 2004). His research with brain injuries led him to the conclusion that intelligence cannot be measured in a simple number, as had been the basis of intelligence through the work of Alfred Binet in the early 20th century (Denig, 2004). Gardner's work led him to put forth a theory that asserts that people do not possess only one form of intelligence but a set of intelligences. Those intelligences are influenced both genetically and through the experiences each person has in his/her life. Gardner's theory recognized that not all people have strengths in the same area (Gardner, 2003). Identifying these strengths may help students learn better (National Research Council, 2000).

While some students may perceive the world through language, others may gain understanding through relationships (McKeachie, 1999). Traditional intelligence

measured through pencil and paper will not necessarily identify the ability of a person (Denig, 2004). Cuban (2004) has put forth the idea that although many educators have subscribed to this theory of multiple intelligences, not many have implemented the theory. Because of the many expectations demanded of the classroom teacher, the most efficient teacher-centered practices have continued to be applied in the classrooms of today. Accepting the theory of multiple intelligences can provide teachers with a better understanding of their students and help them to accommodate the different learning styles that exist within their students (Nolen, 2003). When students learn to recognize their own strengths and weaknesses, they learn to respect the differences in other people and often show a greater willingness to work with and learn from other people (Noble, 2004).

All of the information gained through research can provide educators with a greater challenge as they strive to provide experiences that will aid children in learning. John Dewey set the stage for learning in the 21st century with his early 20th century work in discovery learning. His instructional style of active learning, where the child is an active participant, and deductive learning through problem-solving have provided a foundation for activities in the classroom that enhance the learning experiences of children (National Research Council, 2000).

Cognitive Development

The 20th century scientists and educational psychologists also developed theories on how children learn best. Providing environments in which students can best learn is an important aspect of education.

Piaget

Fundamental in the new learnings of the last century was the importance of active learning for students. Jean Piaget, a Swiss psychologist, conducted work in the early 1920's, developing a theory of cognitive development. Pivotal in his study was the participation of children in learning experiences (Valsiner, 2005). The National Research Council (2000) has summarized Piaget's studies as indicating that children build cognitive structures that continue to increase as they develop. Piaget developed a theory that children move through developmental stages as they seek to learn and understand the world in which they live. Communication with others was an important step in his developmental theory. As children progress through life, their ability to identify and assimilate new knowledge also grows. Primary to Piaget's cognitive development theory was that as children progressed through the stages, reorganization of concepts and new knowledge took place (Qayumi, 2001). Providing an environment in which children might explore their world through inquiry was the foundation of his theory (National Research Council, 2000).

Vygotsky

Leo Vygotsky also played an important role in the cognitive development research (National Research Council, 2000). Inherent in the differences between Vygotsky and Piaget was that Vygotsky felt that cognitive development was gained through interaction with people (National Research Council, 2000). Vygotsky developed a theory of scaffolding, by which a person with knowledge assumes responsibility for the students' learning by guiding the students through a problem-solving process and

gradually transferring responsibility for the learning to the student. DeGrave, Dolmans, and van der Vleuten (1999) defined scaffolding as cognitive distance between what people can accomplish on their own and what they can do successfully with the help of a more knowledgeable person. Vygotsky's Zone of Proximal Development identified the difference between what a student is able to do on his or her own and what he or she is able to do with help (National Research Council, 2000).

Bloom

Benjamin Bloom also did work with cognitive development (McKeachie, 1999). Bloom developed a taxonomy, a framework that encouraged learners to move from simple to complex thinking (See Figure 2). When used with students, Bloom's taxonomy can create opportunities for instructors to cognitively challenge their students (Noble, 2004).

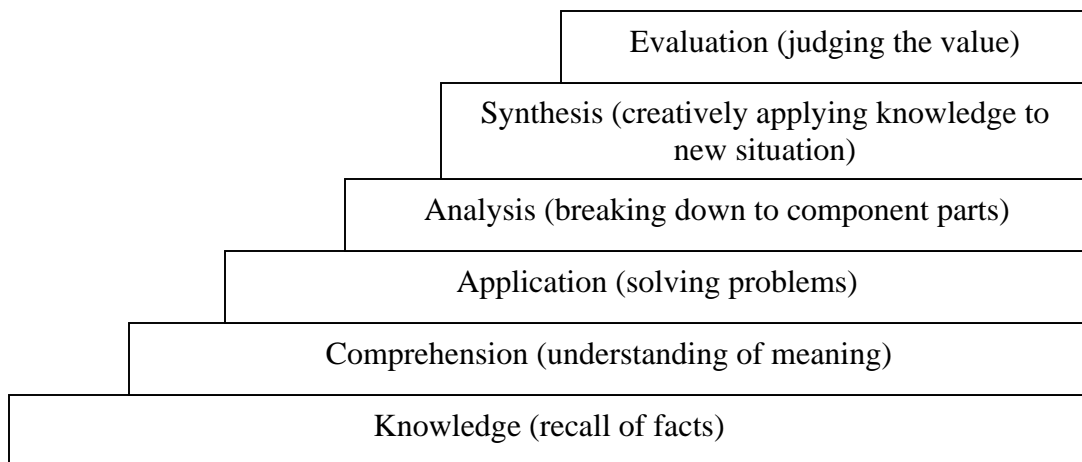


Figure 2: Bloom's Taxonomy Diagram

Bloom's goal for the taxonomy was to provide a structure, or a way of classifying, learning objectives which would challenge the learners to go beyond the basic level of knowledge, where only the facts are retained, to higher levels of assimilation by analysis of new knowledge leading to synthesis and evaluation of that knowledge (Castle, 2003). Bloom's work in the cognitive domain of learning encouraged learning by building on steps of development that would lead both to higher levels of learning and the application of new learning (McKeachie, 1999).

Summary of Process of Learning Research

What has been learned through the research of the 20th century has been in part the recognition that learners are different. Learners differ in the ways in which they learn, in their abilities, in their cognitive processing, and in their development and achievement (Nuckles, 2000). If schools want to provide the best learning opportunities for their students, then efforts should be made by schools to incorporate teaching strategies that will recognize these differences and make an effort to incorporate into the students' learning situations as many variations in style as possible. Students have varying needs and ways of processing information that must be met in order to provide optimal learning experiences (Eby & Herrell, 2005).

It is important that student-instruction go beyond the teaching of facts and concepts at the elementary level and provide opportunities for the learners to be involved in problem-solving processes that encourage multiple sources of information to help determine the outcome possibilities. Students must be allowed to encounter real-life learning situations in order to gain authentic learning (Eby & Herrell, 2005). Education

should have as its focus an understanding of how a child's "capacities, interests and habits" determine the success of that child in his or her learning experiences (Henson, 2003, p. 9). The scientific insights into the cognitive processes and the different strategies needed to engage students in learning should stimulate the educational system to provide the best opportunities for students to learn (Partnership for 21st Century, n.d.).

Providing the best education possible for children is the goal of educators. Traditional instruction has been the dominant method of instruction in classrooms for most of the 20th century. A look at traditional education provides an opportunity to investigate what has been occurring in these classrooms and to get a better understanding of how the traditional classroom works.

Traditional Instruction

The educational process has not changed dramatically over the last few decades (National Center for Educational Statistics, 2000). Although theories of learning and a better understanding of the learning process itself have been studied and discussed, most teachers introduced to these changes have continued to try to incorporate them into the teacher-centered, content-driven instruction of the past century (Choate, n.d.). Cuban (1990) noted that although reforms have been introduced in classrooms, few make it through the door on a permanent basis. He further suggested that reforms have been introduced in a cyclical fashion depending upon which political party currently holds the power. The reforms predominantly reflect the values of the political party in power (Cuban, 1990).

Goal of Traditional Instruction

Student achievement has been the foundation of the traditional classroom (Brown, 2003). Chall (2000), in reviewing the many theories proposed during the 20th century, compared different educational theories to traditional education. Her underlying purpose in writing was her belief that student achievement over the last 50 years has decreased because of the many educational theories that have been explored. She wrote that because student achievement is lower, schools are not preparing learners as well for the advanced technological society in which they will find themselves during their lifetimes. She classified the theories she reviewed as being either teacher-centered or student-centered. Teacher-centered classes may be defined as those in which knowledge has been presented to the learner, whereas student-centered classes are those in which knowledge has been discovered by the learner, where the curriculum has been designed to fit the student rather than the student to fit the curriculum (Cuban, 1990).

Characteristics of Traditional Classrooms

Characteristics of traditional classrooms have included an emphasis on content and skills and the acquisition of these. Thinking and problem solving, based on knowledge from the past deemed important enough to pass on to the future, have been a part of the traditional classrooms incorporated into the content taught (Chall, 2000). The curriculum has been predominantly rooted in the basics of reading, writing, math, science, social studies, and the arts with increasing difficulty in the material added as the basic facts have been mastered (Chall, 2000). Students as learners were expected to learn

what was presented to them in class. Values education has also been an important element in the traditional classroom (Chall, 2000).

Teacher-Centered

The traditional school classroom has been based upon a teacher-centered environment where the instructor has passed on to the students a set of materials that has been deemed important. The materials have been selected and focus more on the content of what is learned rather than the process of learning; gaining knowledge of facts and concepts has been stressed rather than how to use the new knowledge gained (Kain, 2003). Control of the learning was in the hands of those teaching (Brown, 2003). Students have not been encouraged to stray from the curriculum, and the majority of assessment has been measured objectively. Drill and practice have been seen as the beginning of student understanding (Pratt, 2005). Students have been expected to complete the same tasks at the same time under the instructions of the teacher (Schuh, 2004). The curriculum has been presented in a structured, organized fashion (Fardanesh, 2002).

Role of Teachers

In traditional instruction, the teacher has the responsibility to transfer the pre-selected information to the student and has control of what is learned in the classroom (Brown, 2003; Miller, 2003). The teacher has provided knowledge that is well defined and organized so that the learners can assimilate it with what they already have learned (Schuh, 2004). The majority of teachers have been taught didactically and, therefore, tend

to teach the way in which they were taught (LeBaron & Collier, 2001). Didactic instruction, providing a quick way to educate the masses, was the instructional method of the last century. Traditional education has been teacher-centered, passive for learners and built on competition (Henson, 2003). Traditionally, teachers have done a disproportionate amount of the work in the learning process, while the learners have passively sat by waiting for direction from the instructor or waiting for an opportunity to respond to questions asked by the instructor (Lambros, 2002). Teachers have been seen as the experts in the content areas who provide the learners with connections of their prior knowledge to new knowledge (Brown, 2003).

Role of Students

Students have been identified as consumers of information, passive learners, in a traditional classroom (Hasic, 2004). They have been expected to learn the basic skills and content. Although differences in student abilities have been recognized in the traditional classroom, all students are expected to master at least minimal skills in order to progress through the school (Chall, 2000).

Testing

The administration of paper and pencil tests has been identified as another characteristic of traditional classrooms. Tests have been used to identify aptitude as well as mastery of content and skills. To help determine the mastery of the material by the students, educators have used both formal and informal testing. Grades indicating success

or failure of mastery and understanding have also been assigned. Standardized tests have also been used frequently to identify student progress (Chall, 2000).

Delivery Methods

The lecture method of instruction has been at the center of didactic instruction. Students passively absorb the information that has been deemed important to learn (McCarthy & Anderson, 2000). Lecturing as a method of transferring information is seen as a productive way to cover large volumes of material in a short period of time. Activity oriented instruction can take a significantly greater amount of time and often students have strayed down wrong paths in their effort to find a good solution to their problem (Smerdon & Berkham, 1999). McKeachie (1999) has indicated that the lecture and discussion methods can be effective modes of instruction when up-to-date materials are supplied and when the goal is to provide a summarization of material to the learners. These methods can also provide structure to students to guide their learning experiences more effectively. Lecture and discussion as means of imparting information and enhancing retention seem to be more beneficial to the learners than just participating in activities that provide learning opportunities (McCarthy & Anderson, 2000).

20th Century Challenge

Educators of the 21st century have been challenged by the findings of research on learning and how the brain works that was conducted in the 20th century. The passive learning style of the 20th century may not be beneficial to all students and the findings of the 20th century might challenge educators to provide more active learning opportunities

to the students of the 21st century. Traditional instruction has not always reached the students or met their needs (Snyder, n.d.). Duch et al., (2001) found that using only didactic instruction fails to provide opportunities for students to develop their skills and abilities to the fullest. Brown (2003) found that the idea that one teaching style can meet the needs of a diverse and growing student population does not seem feasible.

Challenges to 20th Century Research

Weinig (2000) challenges the findings of the 20th century as far as improving education. He contended that the history of the 20th century denotes the success of the traditional classroom. A nation that has led the world in technology advancements and produced the most educated citizens from classrooms filled with authoritative leaders cannot be failing its students. Classrooms of the 20th century produced respected, educated leaders making a difference in the world.

Hirsch (1996) believed that unless the learning has been directed and monitored by an instructor, true learning might not occur. He used an example of a piano to demonstrate his idea. True learning of piano playing cannot occur without repeated practice. Reading skills have been gained through rote learning. Children must be provided with the tools they need to help them learn and adapt. Research findings have not supported the teachings of those involved in child-centered educational reforms (Hirsch, 1996). No *longitudinal* studies have shown successful implementation of student-centered instructional methods (Hirsch, 1996).

White, Michaud, Pachev, Lirenman, Kolenc, & FitzGerald (2004) conducted a study with 52 family physicians in asthma management using PBL versus didactic

seminars. They found no evidence to show that PBL was more effective than traditional instruction in facilitating knowledge or retention.

Chang's (2003) study with six classes of tenth graders found that those with teacher-directed Computer Assisted Instruction (CAI) improved more in student achievement than those using student-directed CAI. Chall (2000) listed multiple studies (Kennedy, 1978; Stallings, 1975) the conclusions of which showed that traditional instruction provided greater student achievement than student-centered instruction.

Stallings (1975) completed a study of the *Follow Through* classrooms. *Follow Through* was a quasi-experimental, longitudinal study to investigate the success of Head Start following the students through third grade. Stallings reported that reading scores were found to be higher in classes where traditional instruction was implemented than those of non-traditional. A style of reading, asking questions, and gaining responses from the children provided the greatest benefit to students in academic achievement.

Kennedy (1978) did a meta-analysis of the *Follow Through* study including 17 models and projects. *Follow Through* classes were matched with non-*Follow Through* classes. Her findings were similar to Stallings and indicated that more positive results were found in student achievement in those classes that were traditionally structured. There were negative effects recorded in the unstructured classrooms. Additionally, the direct instruction model (traditional) yielded "more immediate and visible results" than the indirect models (non-traditional) (Kennedy, 1978, p. 7).

Cuban (1984) completed a study of 1200 classrooms from 1890-1980. He based his study on descriptions and photographs from this time period. His works showed that

there was a correlation between teacher-centered practices and students achieving high test scores on achievement tests. He concluded that the stability of the teacher-centered classes provided an environment that was beneficial to student achievement.

Elementary teachers have been required to manage 25-40 students at a time. They have been expected to cover academic content while ensuring a depth of understanding in children with different needs and achievement levels (Cuban, 2004). They have successfully managed multiple demands by creating efficient teacher-centered practices that deal with the diverse students with whom they work (Cuban, 2004). Because of the constraints of the classrooms and based upon their own experiences, teachers have tried out innovations and adapted them to the circumstances in which they find themselves, making use of those which will fit into the classroom effectively (Cuban, 2004). Even with reforms in education, teachers have maintained their role as gatekeepers for learning through their adaptation of reforms, or the lack thereof (Cuban, 2004).

Skills for the 21st Century

Twentieth century research provided many different ideas to incorporate into the 21st century classrooms. Introduced towards the end of the 20th century was a tool that might also provide greater opportunities for learning in the classroom.

Skills Identified

The Secretary's Commission on Achieving Necessary Skills (1991) report projects that the demands of the 21st century worker will be different than the past. Reading, writing, and basic arithmetic will not be enough for workers to compete in the

global workplace in which they will find themselves. Workers with thinking skills that will allow analysis, synthesis, and evaluation will replace the workers of the past whose jobs might not have varied much throughout their careers. Workplaces will require their employees to be able to manage resources, work well with other people to produce a product, master complex systems, and work with a variety of technologies. Learners will have to know how to use the knowledge and skills they have by thinking critically, analyzing information, communicating with others, solving problems, and making decisions (Salpeter, 2003). A community will no longer be a shared physical place—communications advancements have provided opportunities for digital interfacing (Bailey, 2003).

The Partnership for 21st Century Skills (2005) has also identified skills needed by the workers of the 21st century. Some of them named were financial and economic skills, information and communication skills, problem-solving skills, interpersonal skills—working well with others, and global awareness. Educators must provide opportunities for learners to develop the skills that they will need in the workplace of the 21st century.

Use of Technology

The invention of the computer during the 20th century has provided a tool for the classrooms to encourage learning. Using computers in the classroom should be a part of the school curriculum. Failure to instruct students in the use of technology would be to produce a worker who would not be able to compete in the job market (Levine, 2002).

Although many schools now have computers and Internet access available in the classrooms, barriers to their usage exist. Many teachers feel ill prepared to integrate

technology into their classrooms because of lack of training or experience (Duhaney, 2001). Some teachers have taken the technology tools provided and tried to fit them into existing pedagogical methods rather than trying different approaches to teaching and learning (Wheeler, 2001). Some teachers have not wanted to relinquish the control of learning to the students in order to create learning opportunities with computers (Wheeler, 2001). However, technology can empower learners to become creative producers of knowledge (Sefton-Green, 2001). Learning communities, groups of novice and expert learners working together to gain knowledge could be formed, which would encourage cooperation and collaboration rather than competition. Technology could become the bridge that connects the building and supporting of these communities (Medina, Pigg, Dresler, & Gorospe, 2001; Riel & Fulton, 2001).

Learning is not limited to the classroom but can extend outside of the four walls of a classroom through the accessing of information and corresponding with other learners from around the world (Abbott & Faris, 2000). Technology advancements have provided opportunities for teachers to reconsider learners' roles in the classroom and the way tasks have been learned in the past (Girod & Cavanaugh, 2001). When teachers see technology as a tool to help accomplish academic goals, then usage will increase (Salpeter, 2003). Students are coming to school with technological skills. Their attitudes and beliefs will have great implications for the way schools provide instruction (National Education Technology Plan, 2004).

Problem-Based Learning

“Curiosity is the beginning of meaningful learning” (Barell, 2001, p. 42).

Curiosity begets questioning which can lead to the discovery of new learning. Problem-Based Learning has been identified as an instructional method by which students are encouraged to learn through discovery and problem solving (Duch et al., 2001). Problem-Based Learning has its roots in John Dewey’s discovery methods of instruction (Delisle, 1997). One of the main purposes of PBL is to aid students in effectively acquiring knowledge like traditional instruction (Morrison, 2004).

Role of the Problem

Key to the implementation of the PBL process should be the problem and the information that can be gained through solving the problem (Harden & Davis, 1998). Students work in teams collaboratively to derive questions about the real-life problem presented to them (Cerezo, 2004). Creating ill-structured problems, problems that may have more than one answer, which will lead investigators to possible solutions should be the goal of PBL (Mergendoller, Bellisimo, & Maxwell, 2000). Through questioning, research, and integration of information, students should determine possible answers to the questions they have framed based upon the problem presented to them.

Importance of Prior Knowledge

Students also should be encouraged to identify their prior knowledge of the subject before beginning to work since the acquisition of new knowledge in the context of prior knowledge strengthens the understanding gained (Johnson & Finucane, 2000).

Learners then integrate their prior knowledge with their new knowledge and explore learning issues that lead them to a new understanding of the issue that has been presented to them (Duch et al., 2001). The learning should require a link between what was understood and the new knowledge presented to the learner in order to develop a better understanding of the knowledge gained (Yildirim, Ozden, & Aksu, 2001). Problem-Based Learning will be most effective when learning reinforces existing knowledge and creates new experiences for the learner that allow the learner to build on what he/she already knows (Lambros, 2002).

Role of Teachers

The instructor's role in PBL should be that of facilitator or guide (Barrows, 2002). Delisle (1997) calls the teacher a curriculum designer since it is the teacher who has the responsibility for developing a relevant problem for the students that will encourage the learning activities in which the students will participate. The teacher should set up the environment for learning and encourage the students as they work together. Problem-Based Learning also allows for intervention in the learning process if the need should arise. Mini-lectures can be incorporated in the process if deemed necessary by the facilitator (Maxwell, Bellisimo, & Mergendoller, 2001). Teachers also serve as evaluators by monitoring the quality of work produced by the learners (Delisle, 1997). To be effective, PBL must have a facilitator active in the process; the PBL process was not intended to stimulate learning without any guidance (Lambros, 2002).

Lima (2001) perceived the instructor's role in the learner-centered classroom as important and valuable as in the traditional classroom. The instructor's role as developer

of the problem has been identified as just as important as the problem. Engaging the students' interest and motivating them to probe for a deeper understanding of the problem and its solutions is crucial to the process. The instructor has the responsibility to structure what occurs in the classroom in the learning process. Content objectives have to be incorporated so that the students gain knowledge in the area they are studying (Duch et al., 2001). Since instructors should serve as guides and provide a safety net for the learners as they progress through PBL (Savin-Baden, 2003), instructors should also be prepared to intervene in the PBL process by asking additional questions that will cause the students to probe for a deeper understanding of the problem and possible solutions (Mierson & Freiert, 2004).

Role of Students

Questioning, researching, and critical thinking should all aid in finding a solution to the problem presented to the learners (Cerezo, 2004). The primary responsibility for determining what should be learned is placed upon the PBL group (Miller, 2003). Learning should take place in the problem-solving process rather than through memorization of content (Miller, 2003). In the PBL process, students will not be expected to master a set of pre-determined right answers but will structure their own right answers through the process rather than be directed to the expected answer by the instructor (Savin-Baden, 2003). Students should be encouraged to take on more responsibility for the learning that occurs and the ownership of that learning as they progress through the PBL process (Barron, Schwartz, Vye, Moore, Petrosino, Zech, & Bransford, 1998).

Problem-Based Learning and 21st Century Skills

Problem-Based Learning provides opportunities for the learner to use skills in higher thinking, problem solving, researching, and communicating—all skills that are desired by business employers of the 21st century (Duch et al., 2001; Partnership for 21st Century Skills, n.d.). Learning to apply content, develop critical thinking skills and communication skills as well as working with team-building should all be part of the PBL process which should lead to skills that will enhance the lifelong learner (Mierson & Parikh, 2000).

Problem-Based Learning follows Vygotsky's theories by allowing students to work with scaffolding as they gain new knowledge and understanding (Harland, 2003). Teachers provide mentoring and support as students explore the new knowledge (Duch et al., 2001). One goal of PBL is to allow students to develop the content knowledge they deem important as opposed to the traditional view of teacher directed learning. The use of metacognitive skills through the PBL process encourages students to become good learners and problem-solvers. It is the learner who brings the experiences to the learning table and determines how that knowledge can be applied in the formation of new knowledge. Active learning is an important part of PBL. Embedded in Vygotsky's theory of development is that learning is best gained through collaborative, problem-solving work in which the use of authentic activities facilitates learning (Harland, 2003).

Problem-Based Learning provides an environment of real life learning as learners solve problems that are relevant to them. It encourages active rather than passive learning, as the students themselves are responsible for research and the knowledge that

they gain. It offers opportunity for choice as students determine what they think is relevant to their learning and how they want to go about searching for the answers to their questions. Problem-Based Learning involves collaborative work, encourages students to value the opinions of others, and promotes discussion and compromise (Delisle, 1997).

The process of PBL presents students with a real-life problem (such as designing a playground for the school or creating rules for a new sport as the commissioner of a new association) and challenges the students to determine a solution or solutions for that problem. After receiving the problem, students determine what learning issues they need to resolve by identifying areas of their problem of which they have no knowledge. Students explore varied resources in their quest for gaining new knowledge about their self-determined learning issues. They continue the process by integrating their prior knowledge with the new knowledge they gained, providing growth in learning and understanding. At the conclusion of their study, students share their newfound knowledge with other classmates and experience further growth in knowledge and understanding of the content topic. The Problem-Based Learning process should culminate in learning being shared with others (Bridges & Hallinger, 1997).

Other benefits to the PBL process have included the development of leadership qualities and team skills as the students progress through the problem and strive together to come to a conclusion (Mierson & Freiart, 2004). Experiences in conflict resolution and learning to compromise because of differences in ideas that other people might have also benefits the students. Students must work through the suggestions of group members and come to a consensus (Mierson & Parikh, 2000). All group members should be expected

to play a role in the PBL process and learn to value the ideas of other group members. They should have a shared responsibility in the outcome (Memory, Yoder, & Williams, 2003). Motivation of students in participation in the learning process as well as in the learning has also been identified as a by-product of PBL (Torp & Sage, 1998).

Challenges for Problem-Based Learning

Problem-Based Learning should not be considered a panacea for education. Concerns have been expressed at the thought that all teaching techniques of the last century should be tossed out in hopes that the new approaches will provide better results in learning (Costlow, 2000). Challenges also have been a part of the PBL process. As with many program changes, there are many obstacles to incorporating the PBL process into classrooms. Inadequate resource availability, too little time designated for change, and class size are a few (Barron et al., 1998). Additional problems identified with PBL have been physical space, less curriculum covered in a given time period, and problems with group dynamics. Incorporating PBL with didactic teaching might offer a solution to some of the aforementioned concerns (Johnson & Finucane, 2000). Too often with PBL, as well, the emphasis has been placed more on the process than on the content to be mastered (Maxwell et al., 2001). Norman & Schmidt (2000) have cautioned that PBL should not be expected to provide dramatically different results in cognitive outcomes. It should, however, “provide a more challenging, motivating and enjoyable approach to education” (Norman & Schmidt, 2000, p. 727).

Problem-Based Learning in Higher Education

Problem-Based Learning has been found predominantly in medical schools. Howard Barrows, a physician and educator, developed the process by which the content was taught through a series of problems introduced to the students (Delisle, 1997). Students were presented with problems and encouraged to develop questions and produce a plan to solve their problems. His work indicated that students became self-directed learners and worked to understand and resolve the problem through inquiry (Delisle, 1997). This outcome was important to Barrows since the medical field is an ever-changing and developing field. With new diseases continually emerging, medical personnel must be prepared to revise their understanding of diseases (Delisle, 1997). Students must be prepared to address new issues, seek resources to provide information concerning the problem, collaborate with others as they develop a plan for addressing the issues at hand, and share the knowledge they have gained with others to increase the knowledge of all learners.

Numerous studies have been done in the medical field using PBL. In a comparison study conducted by Reeves & Francis (2002), PBL and didactic lectures were both used to teach hospital pharmacists about adverse drug reactions. Fifty students participated in the study. The participants were divided into three groups: PBL, didactic, and control. The results of the study showed that both the PBL group and the didactic group successfully learned factual information in order to complete part one of their final test. However, part two of the test indicated that the PBL group scored significantly better

where application of information to patient cases was important. There was no significant improvement in the control group.

Using first term occupational therapy and physiotherapy students, Reynolds (2003) conducted a study using PBL to examine the way males and females evaluate PBL. One hundred fifty-seven students participated (133 women, 24 men). The results indicated that there was no significant difference in attitude between male and female students toward the PBL method. Each group indicated that they were satisfied with their experiences with PBL.

Miller (2003) conducted a PBL study with 22 students enrolled in a pharmacology course. Two sections of the course were taught; the control group consisted of 12 students, and the experimental group (PBL) contained 10 students. The collection of the data was done at mid-term and at the end of the term. Additionally, all students completed a Student Satisfaction With Learning Tool. The findings indicated that there were no significant differences between the two groups at the end. There were differences at the mid-term, however. The scores for the experimental group were skewed to the extremes, indicating, possibly, that students, or possibly the teachers, had not yet mastered the process of PBL. Student satisfaction also did not indicate any statistically significant differences in the two groups.

Few studies on PBL exist outside the medical field. Mergendoller, Bellisimo, & Maxwell (2001) conducted a study in a high school economics class. They worked with 186 students taught by three teachers. The results of their study indicated that although there was no significant difference between the PBL and traditional classes, the

traditional classes did score higher on the test than the two PBL classes. They found no indication that PBL was more successful in helping lower achievers or those with lower academic ability.

Yang (2001) conducted a qualitative Project-Based study implemented with graduate students. Seventeen graduate students participated, nine males and eight females. The results showed a positive attitude by the students regarding the usefulness of PBL and the process through which they went. The study also showed that the student presentations at the completion of the study effectively reflected their understanding of the material and also supported the ease of integration of technology with the PBL process.

Liu (2004) conducted a study with sixth graders for the purpose of examining the performance and attitudes of sixth graders during their use of a Problem-Based Hypermedia experience. The goal of the study was to discover if there was a significant difference when using PBL with a hypermedia class in which there were children of different ability levels. One hundred fifty-five students participated in the study. Three groups of abilities were identified: gifted, regular, and English as a second language or other learning disability (ESL/LD). The results indicated a significant difference among the three ability levels in their performance. The gifted students scored significantly higher on the science test, given at the end of the instruction period, than the regular students and the ESL/LD students. Although the gifted students outscored their counterparts in the other two groups, all groups significantly gained from their starting levels.

Cerezo (2004) conducted a PBL study with 14 at-risk female students. The students were members of math and science classes. The students were divided into four smaller groups according to grade and subject matter. Each group chose a PBL case which was applicable to their subject weakness. The students overwhelmingly provided a positive response to the PBL process and showed that PBL benefited their learning experiences. Having real-life problems was part of the reason the students positively responded to their assignment.

Hall (2004) conducted research in counseling. She compared traditional group counseling with PBL interventions. Her study was with seventh grade victims of bullies. Forty-five students participated. The students were divided into six groups. Two groups participated in the PBL treatment, two groups participated in a traditionally designed curriculum-based treatment, and two groups received no treatment. No statistically significant differences were found among the groups in submissiveness, assertiveness, aggressiveness, and problem-solving skills tests given at the conclusion of the intervention period. At the conclusion of the study, Hall chose to provide those in the groups receiving no treatment a five-session PBL experience. No results of these sessions were included in her study.

Summary of Review of Related Literature

The 20th century scientists and educational psychologists provided much insightful information on the brain, how it functions, diversity of learning styles, and a variety of understandings of the learning process. Their views on how people learn and the best environment for that learning to take place have provided educators with much

on which to ponder as they determine how to provide the best education possible for learners and prepare them for the world in which they will live. Use of technology in the classroom has a role in classrooms. In the ever-increasingly technological world which exists, students must be appropriately prepared to function. The students' expectations about their education have been influenced by the role that technology has played in their world outside of school. Instructional methods that incorporate technology need to be a part of the curriculum.

Traditional instruction has produced successful learners in the past, learners who have taken their place in a global society as leaders. The curriculum has been rooted in content deemed important for learners to be successful in academic achievement as well as in the workplace. The transferring of knowledge through well-defined and organized lessons has provided learners with information upon which they can build as they mature and provided opportunities for growth and re-evaluation of understanding as the student progresses through school. Opportunities for discussion and exploration of concepts through activities have extended the knowledge that was gained through traditional methods of instruction.

A few researchers have challenged the changes encouraged by scientists and educational psychologists contending that the success of workers and leaders in contemporary society should be indicators enough of the success of the traditional classrooms.

Skills of the 21st century worker will be different from the 20th century. Students need practice in applying these new skills. Schools need to provide for those

opportunities of practice. Educators need to incorporate opportunities for acquiring these 21st century skills into curriculum, instruction, and assessment. Schools must provide opportunities for children to prepare to meet the challenges of living in a complex and interconnected global community.

Problem-Based Learning is one instructional method that incorporates findings of the 20th century into the classrooms of the 21st century. With guided instruction, students will be challenged to develop their own learning as they strive to integrate prior knowledge with new knowledge gained through research that they have done themselves. Students determine learning objectives and search for the answers to these objectives, combining their findings collaboratively with their team to produce a solution to the real-life problem that they have received. The Problem-Based Learning method might foster learning that is student directed, that is active, that builds stronger critical thinking skills, and that moves students beyond regurgitation of facts toward creating a new understanding of the knowledge gained.

Changing instructional practices will require significant changes in the school systems of today. A review of research conducted throughout the 20th century has indicated that there is a need to reorient instructional practices to focus on solving authentic problems that will challenge students to think productively. Problem-Based Learning might provide a venue to do just that—restructure instructional processes to provide learners with opportunities to resolve open-ended questions through research and critical thinking, while allowing the learners to take responsibility for their own learning.

Educators should be encouraged to investigate and experiment with the process in their goal for striving to provide the best learning experiences available to their students.

No studies were found that show the effectiveness of PBL in the elementary classroom. This study endeavors to provide research about the effectiveness of PBL at the elementary level.

CHAPTER III

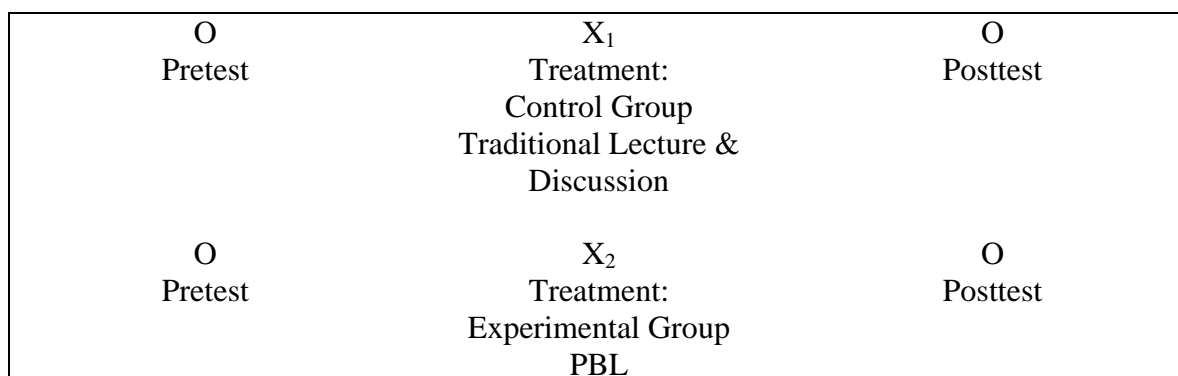
METHODOLOGY

The purpose of this study was to determine if the Problem-Based Learning method of instruction is as effective as traditional instruction in fifth-grade social studies classes for student achievement. Information on the research design and participants will be discussed first. The rest of the chapter will be presented in two parts: the pilot study—science case and the study—social studies case.

Research Design

The research design for this study was quasi-experimental. Gay & Airasian (2000) have defined the use of a quasi-experimental research design as an appropriate design in which the researcher is not able to assign participants randomly to groups. Entire classes were assigned a particular treatment as opposed to individuals being assigned to a treatment. This study used intact classes at the school where the research was conducted; therefore, a quasi-experimental design was used. The type of quasi-experimental research used was a nonequivalent control group design (Gay & Airasian, 2000). This design is similar to a pretest/posttest experimental design except that it

permits non-random assigning of the participants to the groups since randomly assigning participants to a treatment is not possible within the school setting for this study (see Figure 3).



Note. From *Educational Research Competencies for Analysis and Application*, 6th ed. by L.R. Gay & P. Airasian, 2000, p. 391. Adapted by the researcher.

Figure 3: Quasi-Experimental Nonequivalent Control Group Design

Participants

The sample from which the research study was drawn was four 5th-grade classrooms with a population of 104 students in an urban private school in the Southeast. The students attend science and social studies one-half of the academic year. The participants, therefore, were drawn from 52 students enrolled in two science classes for the pilot study and 52 students enrolled in two social studies classes for the research project. Forty-four students of the possible 52 students participated in the science study. Forty-four students of the possible 52 students participated in the social studies study. Students were assigned randomly to classes at the beginning of the school year through a computer-generated program. No attempt was made to further randomize them. The classes participating in the study stayed intact. Each class was assigned to one of two

groups—experimental or control. The intact classes were heterogeneously grouped for ability. No attempt was made by the school to group them homogeneously. An attempt to distribute gender groups evenly among the classes was made by the school at the beginning of the year through the use of the computer program.

Pilot Study – Science Case

This section contains information specific to the science pilot study. Included in this section is information about instrumentation, reliability and validity, procedures, and data analysis.

Instrumentation

The science study covered two parts of a science unit on plants. This unit was a part of the regular curriculum. The science topics studied included information about the processes of photosynthesis, food webs, respiration, transpiration, tropisms, and adaptations of plants.

The written content instrument used in the science research project for the pretest and posttest was created by the publisher of the textbook, Concordia Publishing House, and was designed to test the content material covered by the text. The science test has been used for two years in the school. The science test was made up of multiple choice, true/false, and matching questions.

All students were required to participate in a group presentation detailing the information they had learned. A researcher-designed rubric was used for the presentation assessment (Appendix A).

Reliability and Validity

Quantitative studies contain many possible threats to internal and external validity (J. Xu, personal communication, August, 2002). Two 5th grade classroom science instructors reviewed the written content test and determined that it was a valid test for content. A Pearson correlation for the data revealed that test scores from two years were significantly related, $r = +.53$, $n = 44$, $p < .01$, two tails indicating the reliability of the content test.

Two experts in the area of PBL as well as the assistant principal of the school reviewed the researcher-designed group presentation assessment and determined that it was a valid instrument to measure the components of content, participation in presentation, use of technology, and research effort. A correlation for the data revealed that the rubric scores were significantly related, $r = -.40$, $n = 40$, $p < .05$, two tails. The researcher-designed science case was also submitted to the experts in PBL and was found appropriate to elicit measurable responses for the study (See Appendix B).

Threats to internal validity for this study included: subject characteristics, attitude of subject participants, location, history, and implementation. Subject characteristics that might influence the results of this study might be gender, achievement levels, or age.

Students stayed in intact classes throughout the study. Using a computer program, students were randomly assigned to a class at the beginning of the year. No attempt to assign them to a different class was made by the researcher. An attempt to divide the classes for gender balance was also made at the beginning of the school year. No further attempt was made to adjust the number of males and females in each class. No attempt

was made to distribute or assign students to classes by academic achievement. There might have been one class that might have had more females or males than the other, one class that contained students with higher achievement levels than the other class; or might have had older children than the other.

Other possible internal threats could have been the John Henry effect whereby the students in the control group (traditional instruction) might have been challenged to score as well as those who were in the experimental group. The Hawthorne effect, whereby the participants react differently than anticipated because of being studied, might have caused unexpected results. The researcher made every effort to normalize classrooms and students as the study progressed and to treat each class as normally as possible.

Location also might have been another threat to this study. Students had a new teacher (researcher) to which they had to adjust. In addition, all students were involved in changing classes for the first time. Students in fifth grade change classes for science and social studies. For the first time, they were not with their regular classroom teacher for instruction. Both classes received instruction from the researcher and changed location from their classroom. Equalization of conditions was similar in both classes.

The occurrence of spring break during the pilot study might have produced a threat to the history of the study. Spring break fell two weeks before the conclusion of the pilot study. This break could have caused students to lose interest in the work in which they were involved or be distracted from the goal of learning by the time off.

Also, a possible threat to this study was the bias of the researcher. The researcher was the primary instructor for both classes. In order to avoid bias, the researcher

requested and received outside grading of the group presentation assessment. The assistant principal was asked to grade the group presentations using the researcher-designed rubric. She graded all presentations for science and social studies. Videotaping of the presentations was also done to provide adequate review of presentations if the assistant principal desired.

The threat of repeated testing might also have been a limitation since the pretest and posttest were the same test. Lack of random sampling or assignment might also have been a possible threat.

The greatest threat to this research project was the external threat of nonrepresentativeness. The participants of the project were predominantly of Euro-American descent. The school enrolls less than five percent minority students. Those students are spread out over seven grades, thereby reducing the minority population per grade. Not having a diverse group of participants might restrict the application of the findings to the general population. Additionally, the students were enrolled in a private, religious school. These factors might also threaten the validity of the study.

Procedures

A pilot study was conducted in two 5th-grade science classes prior to the commencement of the study in social studies in order to test the research plan. Conducting the pilot study in science was chosen because of the constraints of the school program. The school provides science instruction one-half of the year and social studies instruction the other half of the year with two classes having science while the other two

classes are having social studies. Students enrolled in science had already completed their half-year study in social studies in the fall prior to this study.

Gay and Airasian (2000) described a pilot study as a “dress rehearsal” (p. 111) of the actual study. They have specified that all or part of the plan may be tried out. The purpose of the pilot study was to identify areas of the study that might need to be revised or changed before conducting the actual research. The goal of a pilot study is to “identify unanticipated problems or issues” (Gay & Airasian, 2000, p. 111). Changes to the plan could be made to accommodate any problems prior to the research study being implemented.

The study took place in an urban private school in the Southeastern United States. A letter requesting permission to obtain student data and conduct the research study was given to the headmaster of the school. The letter granting permission was received from the headmaster. Approval to conduct the research was sought and granted from the Institutional Review Board (IRB) of Mississippi State University (see Appendix C). Letters of consent and assent were sent to the parents and students respectively prior to the commencement of the study and only those students from whom permission was received were participants in the project (See Appendix D).

The sample from which the research study was drawn was 44 students enrolled in two science classes. Two intact science classes participated in the pilot study. The researcher randomly assigned treatments, control (traditional instruction) or experimental (PBL), through the drawing of a slip of paper from a hat. Students in both groups were given a written pretest to determine their prior knowledge of plants, the science unit

selected for the pilot study. The written content instrument used in this study for the pretest and posttest was created by the publisher of the textbook, Concordia Publishing House, and was designed to test the content material covered by the text. The school had used the written test for two years to measure the content learning gained. The written test included a variety of multiple choice, true/false, and matching statements.

The researcher designed the rubric used for the presentation assessment. The validity of the rubric was established through content expert review. Two people who were trainers and instructors in PBL reviewed the presentation assessment rubric. The content objectives for the chapter were measured as well as participation, use of technology, and research effort made by the students.

Control Group (Traditional)

The school, in which the research was conducted, had historically used traditional methods of instruction in the classrooms. The participants in the control group were taught traditionally with lecture and discussion method as had been done in their regular classroom. A pretest was given before the instructional period began. Students in the control group were assigned pages to read and discuss with the instructor and questions to answer from the textbook (see Appendix E). Diagrams of photosynthesis and the food chain were drawn and labeled. Students were provided materials to use to plant seeds according to the information learned in the reading. At the end of the study, students were randomly assigned by their regular classroom teachers to small groups of five to six students who worked together to create a presentation of what they had learned about the material and asked to present to the class a summary of the information they had learned

about plants. The students received information concerning their presentations two weeks prior to the assigned date for the presentation (See Appendix F). The researcher reviewed the guidelines, rubric, and rubric definitions with students in each class. Each group was given time at school to work on the presentation. Two days after the last presentation, a written posttest was given to measure the knowledge they gained about the studied topic.

Experimental Group (Problem-Based Learning)

Following the written pretest, participants in the experimental group (See Appendix G) used the PBL five-step process (See Appendix H). Students participating in this study had participated in another PBL process prior to their participation in the pilot study. Students had participated in a history class using PBL in the fall. They received a researcher-created case (See Appendix B). They used the five-step process of PBL in which they were asked to identify the facts in the case and determined open-ended questions based upon the facts. They used these questions to determine the learning objectives for their study and conducted research to gain knowledge and to answer their questions. Materials were also provided for these students if they chose to plant seeds as part of their research. Students worked in groups of five to six throughout the learning process. The students compiled a list of resources on a paper posted in the class. A presentation of the knowledge gained based upon the learning objectives determined by each group was delivered at the conclusion of the study. The assistant principal assessed the presentations. Videotaping of the presentations was done to allow for review if any questions concerning an assessment arose.

The researcher-designed assessment rubric (See Appendix A) was used to identify content knowledge gained through a group presentation. A written posttest was given at the conclusion of the study to measure the content knowledge gained through the study on plant adaptation and processes instrumental in plant survival. An analysis of the data from the written test and the assessment rubric was conducted through the use of SPSS software.

Data Analysis

The research question addressed was: Is PBL as effective an instructional method at the elementary level as traditional instruction in learning content? Independent measures *t*-test are used when the evaluation of the mean difference comes from two treatment conditions (Gravetter & Wallnau, 2000). Upon completion of the pilot study, analysis was run to compare the means of the posttest scores and the group assessment scores of the two groups, experimental and control, using independent-measures *t*-test analysis. The confidence level for the *t*-tests was 95%.

The independent variable (Y) was teaching method. The dependent variable (X_1) was the posttest scores. A second analysis was run using the same independent variable of teaching method with the group presentation scores as the dependent variable (X_2).

An analysis of variance (ANOVA) was run to determine whether the differences in the test results were affected by the treatment effects or simply by chance. Again, the independent variable was teaching method. Analyses were run using the dependent variables of posttest (X_1) and group presentation scores (X_2).

An analysis of covariance (ANCOVA) was also conducted to determine whether prior knowledge of the content impacted the results of the *t* test analysis. A covariate of pretest scores was used. The purpose of a covariate is to neutralize large discrepancies, or variance, in a set of scores and to make the findings more reliable (Howell, 2002). Using the covariate of pretest neutralized the possibility of a discrepancy in scores of the posttest. The ANOVA, ANCOVA and covariate were considered significant at the .05 level.

At the conclusion of the pilot study, the researcher reviewed the process and findings. The length of time for the science study was too short to accomplish all that was done. Some students chose to work outside of class time in order to complete their assignment. It was determined that a longer period of time would be beneficial to the process so the social studies study was extended for two additional weeks. Additionally, it was determined that it was beneficial to the understanding of the PBL process to begin each new step together as a class, working ten to fifteen minutes together before breaking into the small groups. The concept for each step was introduced to the students as a large group. The beginning of each step was done initially together and then each small group began working themselves.

Research Study – Social Studies Case

This section contains information about the social studies study. Included in this section is information about instrumentation, reliability and validity, procedures, and data analysis.

Instrumentation

The material for the social studies research project included studies of ancient kingdoms and empires that existed in the Middle Eastern region of the world. The textbook followed the experiences of the Israelites and the other groups that they encountered in the years prior to the birth of Christ.

The written content instrument used in the social studies research project for the pretest and posttest was created by the publisher of the textbook, A Beka Book, and was designed to test the content material covered by the text. The school has used the written test for the social studies study for five years to measure the content learning gained. The social studies test consisted of short answer, multiple choice, true/false, listing, and map labeling. A correlation for the data revealed that test scores from two years were significantly related, $r = +.37$, $n = 40$, $p < .05$, two tails.

Reliability and Validity

The researcher-designed social studies case was submitted to the experts in PBL, who had been involved in training others in using PBL, and was found appropriate to elicit measurable responses for the study (See Appendix I). The same rubric and definitions were used for the social studies research as were used for the science research (See Appendix A). A correlation for the data revealed that the rubric scores were significantly related, $r = -.40$, $n = 40$, $p < .05$, two tails indicating the reliability of the written content test.

Threats to internal validity for this study included: subject characteristics, attitude of subject participants, location, history, and implementation. Subject characteristics that could influence the results of this study were gender, achievement levels or age.

Students stayed in intact classes throughout the study. Using a computer program, students were randomly assigned to a class at the beginning of the year. No attempt to assign them to a different class was made by the researcher. An attempt to divide the classes for gender balance was also made at the beginning of the school year. No further attempt was made to adjust the number of males and females in each class. No attempt was made to distribute or assign students to classes by academic achievement. There might have been one class that contained more females or males than the other, there might have been one class of students with higher achievement levels than the other class; or might have had older children than the other.

Other possible internal threats could have been the John Henry effect whereby the students in the control group (traditional instruction) might have been challenged to score as well as those who were in the experimental group. The Hawthorne effect, whereby the participants react differently than anticipated because of being studied, might have caused unexpected results. The researcher made every effort to normalize classrooms and students as the study progressed and to treat each class as normally as possible.

Location also might have been another threat to this study. Students had a new teacher (researcher) to which they had to adjust. Both classes received instruction from the researcher and changed location from their regular classroom. Equalization of conditions was similar in both classes.

The social studies project occurred in the final weeks of the school year. The approach of summer might have produced a threat to the history of the study, as students might not be as interested in schoolwork with the anticipation of ending the school year.

Also, a possible threat to this study was the bias of the researcher. The researcher was the primary instructor for both classes. In order to avoid bias, the researcher requested and received outside grading of the group presentation assessment. The assistant principal was asked to grade the group presentations using the researcher-designed rubric. The assistant principal assessed all group presentations for the social studies classes. Videotaping of the presentations was also done to provide adequate review of presentations if the assistant principal desired.

Another threat might have been repeated testing since the pretest and posttest were the same test. Lack of random sampling or assignment might also have been as a possible threat.

The greatest threat to this research project was the external threat of nonrepresentativeness. The participants of the project were predominantly of Euro-American descent. The school enrolls less than five percent minority students. Those students are spread out over seven grades, thereby reducing the minority population per grade. Not having a diverse group of participants might restrict the application of the findings to the general population. The students were enrolled in a private, religious school. These factors might also threaten the validity of the study.

Procedures

Letters of consent and assent were sent to the parents and students respectively prior to the commencement of the study and only those students from whom permission was received were participants in the project (See Appendix J).

The study in social studies was conducted with two intact classes involving approximately 52 students. The students studied a unit on ancient kingdoms and empires of the Middle East existing prior to the birth of Christ. The classes were randomly assigned a treatment through the drawing of an instructional method name from a hat by the regular classroom teacher. Both classes received a written pretest using a test developed by the book publisher, A Beka Book.

Control Group (Traditional)

The school uses the traditional method of instruction as a predominant method of teaching. The control group received traditional instruction (Appendix K) of lecture and discussion methods. The topic was the kingdoms and empires of the ancient world. Students read the text about the Phoenicians, Hittites, Lydians, Israelites, the Assyrian Empire, the Babylonian Empire, and the Persian Empire. Students read the text with the teacher, discussed the material read, and then were asked to answer study questions on the material.

Students were randomly assigned by their regular social studies teachers to small groups of five to six students who worked together to create a presentation of what they had learned about the material. At the conclusion of the study, group presentations were given to the class as a summary of what they learned about the kingdoms and empires of

the ancient world. The students received information concerning their presentations two weeks prior to the assigned date for the presentation. The researcher reviewed the guidelines, rubric, and rubric definitions with each class. Each group was given time at school to work on the presentation. Two days after the last presentation, the written posttest was given to measure the knowledge they gained about the studied topic.

Experimental Group (Problem-Based Learning)

The experimental group (Appendix L) conducted their study on kingdoms and empires of the ancient world by using the five-step PBL process (Appendix M). Students in the social studies study had no other experience with the PBL process at school prior to the commencement of this study as this school has used traditional instruction since its incorporation. Students were given a researcher-designed case (See Appendix I) from which they determined the facts known about their problem, developed open-ended questions in order to solve the problem, and determined the learning goals that they would research. Research was conducted using resources of their choice. Subject books, encyclopedias, and Internet access were available for use in research. At the conclusion of their study, each small group made a presentation to the rest of the class to demonstrate what the group had learned in their study (See Appendix F). Additionally, the written posttest was given to measure what knowledge was gained through the study. The written test scores and the scores from the presentation rubric were used to analyze the effectiveness of the PBL method. The presentation rubric was also used to gain information about any additional possible benefits from using the two instructional methods, traditional instruction and PBL. The assistant principal assessed the

presentation. Videotaping of the presentations was done to allow for review if any questions concerning an assessment arose.

Data Analysis

The research question addressed was: Is Problem-Based Learning as effective an instructional method at the elementary level as traditional instruction in learning content? No adjustments to analyses were made after the pilot program. The same analyses were run at the conclusion of the social studies research study.

Upon completion of the pilot study, statistical analysis was done to compare the means of the test scores of the two groups, experimental and control, using independent *t*-test analysis. Independent measures should be used when the evaluation of the mean difference comes from two treatment conditions (Gravetter & Wallnau, 2000). The confidence level for the *t*-tests was 95%.

The independent variable (Y) was teaching method. The dependent variable was the posttest scores (X₁). A second analysis was run using the same independent variable of teaching method (Y) with the dependent variable being the presentation assessment rubric (X₂).

An analysis of variance (ANOVA) was run to determine whether the differences in the test results were affected by the treatment effects or simply by chance. The independent variable of teaching method (Y) was used with the dependent variables of posttest scores (X₁) and group presentation scores (X₂).

An analysis of covariance (ANCOVA) was also conducted to determine whether prior knowledge of the content impacted the results of the *t*-test analysis. A covariate of

pretest scores was used. The purpose of a covariate is to neutralize large discrepancies, or variance, in a set of scores and to make the findings more reliable (Howell, 2002). The covariate of prior knowledge was used to neutralize any discrepancies seen in the posttest scores. The ANOVA, ANCOVA and covariate were considered significant at the .05 level.

CHAPTER IV

RESULTS

This chapter presents a description of the results and the analysis of data. The purpose of this study was to determine if Problem-Based Learning is as effective an instructional method at the elementary level as traditional instruction in learning content. Data analysis was used to examine the research question. An analysis of a written pretest and posttest as well as a score from a group presentation assessment was used to determine the effectiveness of the teaching methods.

A pretest-posttest research design was used in this quasi-experimental research project. A pilot study was conducted in a science class prior to the research study in social studies. Data was collected from 44 students in the pilot study in science and 44 students in the social studies research project. Students received a pretest prior to beginning the studies. The pilot study in science was conducted over a four-week time period. The research project in social studies was conducted over a six-week period. At the conclusion of the study, a written posttest was given to all students. A group presentation assessment was also used to collect data. The findings of these analyses were

used to answer the question: Is Problem-Based Learning as effective an instructional method as traditional instruction in learning content?

Data were analyzed using SPSS for Windows, Release 11.5 (2002). Analysis procedures include *t* test, Analysis of Variance (ANOVA), and Analysis of Covariance (ANCOVA).

This chapter includes a section on descriptive data and test score analysis. The data is presented in two parts: the pilot study in science and the research project in social studies.

Findings of the Pilot Study

The pilot study in science was conducted prior to the research project in social studies. This part of the chapter will contain: descriptive data, test score analysis, and a summary about the findings of the pilot study.

Descriptive Data

Data were collected on 44 students in two 5th-grade classes in an urban private school in the Southeast. Twenty students were members of the traditional class; 24 students were members of the Problem-Based Learning class. Table 1 indicates the demographics of students according to the method of instruction.

Table 1: Demographics of Students by Instructional Method

	Traditional Instruction	Problem-Based Learning	Total
Pretest	20	24	44
Posttest	20	24	44
Group Presentation	20	24	44

Test Score Analysis

The research question for this study was: Is Problem-Based Learning as effective an instructional method at the elementary level as traditional instruction in learning content? Posttest scores and a group presentation assessment provided data for analysis.

The posttest scores were examined first. Before analyzing the data, assumptions for the independent measures *t*-test were checked. Independent-measures *t*-test allows the comparison of the means of two treatments (Gravetter & Wallnau, 2000). The assumptions of independence, normality and homogeneity of variance were satisfied for the posttest. The Shapiro-Wilk test was used to determine normality ($p = .410, p > .5$). The indication of $p > .05$ indicates that the scores are normally distributed around the mean. Levene's test of homogeneity was observed to determine homogeneity of variance ($p = .712, p > .05$). The Levene test results of $p > .05$ indicate that there is equal variance in the scores.

The *t*-test showed a significant difference of $p = .001, p < .05$, two-tailed (See Table 2). The students taught traditionally ($M = 88.20, SD = 5.46$) scored significantly higher on the written posttest than did those taught with Problem-Based Learning ($M = 82.33, SD = 5.20$) (See Table 3). Both groups made gains in student achievement from

their pretest scores. The traditionally instructed students' gains were significantly greater than those taught with Problem-Based Learning.

Table 2: Independent-Measures *t*-test results – pretest, posttest, group presentation

	<i>t</i>	df	Sig. (2-tailed) <i>p</i>	Mean Difference
Pretest	.901	42	.373	1.25
Posttest	3.643	42	.001*	5.87
Group Presentation	5.037	42	.000*	12.28

* $p < .05$

Table 3: Student Achievement *t*-test Descriptives – pretest, posttest, group presentation

	Instructional Method	N	Mean	Std. Deviation
Pretest	Traditional	20	76.75	4.47
	PBL	24	75.50	4.67
Posttest	Traditional	20	88.20	5.46
	PBL	24	82.33	5.20
Group Presentation	Traditional	20	100.40	8.89
	PBL	24	88.13	7.28

Assumptions for the independent-measures *t*-test for the group presentation assessment scores were examined. The assumptions of independence, normality and homogeneity were satisfied. The Shapiro-Wilk test was used to determine normality ($p = .052, p > .05$). Levene's test of homogeneity was observed to determine homogeneity of variance ($p = .881, p > .05$). *P* values for the Shapiro-Wilk test and Levene's test greater

than the confidence interval of .05 indicate that the data is normally distributed and that there is an equal variance in the scores, respectively.

The independent-measures *t*-test showed a significant difference of $p = .000$, $p < .05$, two-tailed (See Table 2). The student achievement scores for those students in the traditional class ($M = 100.40$, $SD = 8.89$) were statistically significant different from those students in the Problem-Based Learning ($M = 88.13$, $SD = 7.28$) (See Table 3) on the presentation assessment scores. Scores over 100 were assigned based upon bonus points that were available to all groups.

T-tests were run on use of technology and participation. No significant differences were found, $p > .05$ for technology and participation.

The independent-measures *t*-test results of this analysis indicate that those learning through means of traditional instruction were more successful in student achievement than those learning through the use of Problem-Based Learning.

An Analysis of Variance (ANOVA) was used to “evaluate the mean differences between two or more treatments” (Gravetter & Wallnau, 2000, p. 397). Analysis of Variance is used to determine whether the differences are caused by the treatment effects or simply by chance. An alpha of .05 was used to evaluate the data.

The assumptions of ANOVA were evaluated. Independence was assumed. Levene’s test of homogeneity showed no evidence of problems with the assumption of homogeneity $p > .05$ for either the posttest or the group presentation. The Shapiro-Wilk test for normality showed that there was no violation for the assumption of normality $p > .05$ for the written posttest and the group presentation assessment.

The Analysis of Variance indicated a statistically significant difference in the instructional methods of traditional ($M = 88.20$, $SD = 5.46$, $n = 20$) and Problem-Based Learning ($M = 82.33$, $SD = 5.20$, $n = 24$) (See Table 4) with the posttest, $F(1, 42) = 13.27$, $p < .05$, $p = .001$ (See Table 5). An alpha of .05 was used. This finding indicates that the differences in the treatments are 13 times more likely to occur than by chance.

Table 4: Descriptives for Instructional Methods

	Instructional Method	N	Mean	Std. Deviation
Pretest	Traditional	20	76.75	4.47
	PBL	24	75.50	4.67
Posttest	Traditional	20	88.20	5.46
	PBL	24	82.33	5.20
Group Presentation	Traditional	20	100.40	8.89
	PBL	24	88.13	7.28

Table 5: Analysis of Variance for Instructional Methods

Source	df	<i>F</i>	<i>p</i>
Between subjects			
Posttest	1	13.27	.001*
Group Presentation	1	25.37	.000*
Source	df	<i>F</i>	<i>p</i>
Within subjects			
Posttest	42		
Group Presentation	42		

* $p < .05$

The Analysis of Variance (ANOVA) was used to evaluate the data of the group presentation assessment also. The alpha was .05. The ANOVA indicated a statistically significant difference in the scores from the instructional methods of traditional ($M = 100.40$, $SD = 8.89$, $n = 20$) and Problem-Based Learning ($M = 88.13$, $SD = 7.28$, $n=24$) (See Table 4) with the posttest, $F(1, 42) = 25.37$, $p < .05$, $p = .000$ (See Table 5). This finding indicates that the differences in the treatments are 25 times more likely to occur than by chance.

An Analysis of Covariance (ANCOVA) was run for the purpose of determining whether prior knowledge impacted the test results of the posttest or group presentation. The check of homogeneity of regression assumption was satisfied, $p > .05$. Two ANCOVA's were run using posttest as the dependent variable in one and the group presentation assessment scores as the dependent variable in the other.

The results of the first ANCOVA, with the posttest scores as the dependent variable, indicated that there was a statistically significant difference between the methods of instruction, $F(1, 41) = 13.43$, $p < .05$, $p = .001$ (See Table 6).

Table 6: Analysis of Covariance – Posttest

Source	df	F	p
Between subjects			
Pretest	1	16.64	.000*
Instructional Method	1	13.43	.001*
Source	df	F	p
Within subjects			
Pretest	41		
Instructional Method	41		

*p<.05

Students with traditional instruction ($M = 88.20$, $SD = 5.46$, $n = 20$) performed higher than those students learning through Problem-Based Learning ($M = 82.33$, $SD = 5.20$, $n = 24$) (See Table 7).

Table 7: Descriptives for Instructional Methods

	Instructional Method	N	Mean	Std. Deviation
Pretest	Traditional	20	76.75	4.47
	PBL	24	75.50	4.67
Posttest	Traditional	20	88.20	5.46
	PBL	24	82.33	5.20
Group Presentation	Traditional	20	100.40	8.89
	PBL	24	88.13	7.28

The results of the second ANCOVA, with the group presentation scores as the dependent variable, also indicated that there was a statistically significant difference

between student scores based on the methods of instruction, $F(1, 41) = 24.11, p < .05, p = .000$ (See Table 8).

Table 8: Analysis of Covariance – Group Presentations

Source	df	<i>F</i>	<i>p</i>
Between subjects			
Pretest	1	.020	.887
Instructional Method	1	24.11	.000*
Source	df	<i>F</i>	<i>p</i>
Within subjects			
Pretest	41		
Instructional Method	41		

* $p < .05$

Students receiving traditional instruction ($M = 100.40, SD = 8.89, n = 20$) performed higher than those students learning through Problem-Based Learning ($M = 88.13, SD = 7.28, n = 24$) (See Table 7).

The data showed that the power for the ANCOVA, with posttest scores as dependent variables was high (.947). With .80 showing good power, these results show strong power of the analysis. Power of a test indicates the probability “that the test will correctly reject a false null hypothesis” (Gravetter & Wallnau, 2000, p. 271).

The data showed that the power for the ANCOVA, with group presentation scores as dependent variables was .998. With .80 showing good power, this result indicates strong power.

A correlation was run to verify that the covariate was an appropriate choice.

Running a one-way ANOVA at an alpha level of .05, ($p > .05$) comparing pretest scores

of the students showed that there was not a significant difference in the scores for the two groups. This indicates that the covariate of pretest had no impact on the outcome of the analysis.

Summary of Pilot Study

The research question was: Is Problem-Based Learning as effective an instructional method at the elementary level as traditional instruction in learning content? This research design was quasi-experimental. A pretest-posttest was used with the publisher-produced instrument. A researcher-designed group presentation was used to score the group presentations. There was a statistically significant difference between the student scores based on the two methods of instruction. Although all students showed a gain in student achievement, those students receiving instruction through traditional methods scored significantly higher than those taught using Problem-Based Learning.

The data analysis indicated that there was a significant difference in student achievement between traditionally instructed students and students learning with the Problem-Based Learning process. Although both groups made gains in knowledge, the traditional students were more successful in acquiring content knowledge than those who learned with Problem-Based Learning.

Although the analyses indicated a significant difference in the student achievement between the two instructional methods, other factors should be considered in making a decision as to the effectiveness of PBL as an instructional method. Since the school has predominantly taught using traditional methods of instruction, the students in the control group may have been more comfortable in the learning process than those

using a method of instruction that was not as familiar. Students using PBL reported a struggle with determining what to study in preparation for the written content test, as no study materials were available until the completion of the presentations two days before the written test. Additionally, those students using PBL went beyond the textbook information on plants and experimented with freezing temperatures to determine if plant life could be sustained on Mars as the problem challenged them to consider. They also experimented with plants and the need for soil in order for the plants to grow. PBL students gained understandings of plants and plant growth that were not measured on the written test they were given at the conclusion of the study. A written objective test does not always measure all learning that took place.

Findings of the Research Project

The research study was conducted in social studies. This part of the chapter will contain: descriptive data, test score analysis, and a summary about the findings of the research study.

Descriptive Data

Forty-four students participated in the social studies research project. Twenty-two students were members of the traditional class; 22 students were members of the Problem-Based Learning class. Table 9 indicates the demographics of students according to the method of instruction.

Table 9: Demographics of Students by Instructional Method

	Traditional Instruction	Problem-Based Learning	Total
Pretest	22	22	44
Posttest	22	22	44
Group Presentation	22	22	44

Test Score Analysis

Before analyzing the data, assumptions for the independent measures *t*-test were checked. The results of the descriptive statistics indicated a problem with the normal distribution of the group presentation assessment scores ($p < .05$) and the homogeneity of variance in the posttest scores. The Shapiro-Wilk test was used to determine normality. Levene's test of homogeneity was observed to determine homogeneity of variance.

Investigations of the histograms and stem and leaf plots indicated negatively skewed data. Too many grades were stacked up at the high end of the distribution curve. Outliers were removed and transformations attempted. Arcsine successfully distributed the data so that homogeneity of variance was satisfied for the group presentation scores and the posttest scores, $p > .05$. The purpose of arcsine is to stretch out the curve at both ends of the tail (Howell, 2002). No attempt at transformation or removal of data was successful at distributing the data of the group presentation to acceptable normal statistics, $p < .05$. Analyses discussed in this paper include both findings of the transformed data and the non-transformed data (original). Transformations simply re-express the data that was collected. Conclusions drawn from transformed data do not always reflect the same conclusions as the non-transformed data (Howell, 2002).

The assumptions of independence and normality were satisfied before transformation of the data for the posttest scores. The homogeneity of variance was $p = .005$, $p < .05$ prior to arcsine transformation. After transformation, the assumption of homogeneity of variance was satisfied, $p = .302$, $p > .05$.

There was no statistically significant difference in the posttest scores between students learning traditionally and those using Problem-Based Learning, $p = .376$, $p > .05$ (See Table 10).

Table 10: Independent-Measures t test results after transformation—pretest, posttest, group presentation

	t	df	Sig. (2-tailed) p	Mean Difference
Pretest	-1.836	38	.074	-5.550
Posttest	.895	38	.376	.178
Group Presentation	-2.388	38	.022*	-.246

* $p < .05$

The students taught traditionally ($M = -.17$, $SD = .67$, $n = 20$) did not score significantly different from those taught with Problem-Based Learning ($M = -.35$, $SD = .58$, $n = 20$) (See Table 11) on the posttest.

Table 11: Student Achievement Descriptives after transformation—pretest, posttest, group presentation

	Instructional Method	N	Mean	Std. Deviation
Pretest	Traditional	20	51.60	8.38
	PBL	20	57.15	10.61
Posttest	Traditional	20	-.17	.67
	PBL	20	-.35	.58
Group Presentation	Traditional	20	-.22	.36
	PBL	20	.03	.29

Non-transformed data (original) also indicated that there was no statistically significant difference between the posttest scores of those students taught traditionally ($M = 83.00$, $SD = 9.87$, $n = 22$) than those taught with Problem-Based Learning ($M = 74.50$, $SD = 15.53$, $n = 22$).

Table 12 shows the descriptives for the pretest, posttest, and group presentation assessment before transformation of the posttest and the group presentation scores. Outliers were also removed before the data was transformed; thus there are fewer scores considered in the transformed data than in the non-transformed (original) data.

Table 12: Student Achievement Descriptives non-transformed data (original)—pretest, posttest, group presentation

	Instructional Method	N	Mean	Std. Deviation
Pretest	Traditional	22	51.73	8.03
	PBL	22	57.00	10.44
Posttest	Traditional	22	83.00	9.87
	PBL	22	74.50	15.53
Group Presentation	Traditional	22	91.27	9.30
	PBL	22	93.05	5.51

For the group presentation assessment, only the assumption of independence was satisfied prior to the transformation of the data. Normality of distribution was never achieved through transformation. Homogeneity of variance was satisfied through the arcsine transformation ($p = .539, p > .05$).

The t -test indicated that there was a statistically significant difference in the student achievement ($p = .022, p < .05$) (See Table 10) for those taught traditionally ($M = -22, SD = .36, n = 20$) than those taught with Problem-Based Learning ($M = .03, SD = .29, n = 20$) (See Table 11) on the group presentation. The students involved in the Problem-Based Learning scored higher than those receiving traditional instruction.

Non-transformed data (original) analysis indicated that there was no statistically significant difference between the student scores based on the two methods of instruction, traditional ($p = (M = 91.27, SD = 9.30, n = 22)$ or Problem-Based Learning ($M = 93.05, SD = 5.51, n = 22$) (See Table 12) on the group presentation. There was a conflict between transformed data and the non-transformed data (original) in the analysis results as to whether or not there was a statistically significant difference between the

instructional methods. The transformed data indicated that there was a significant difference between the scores of the two methods; the non-transformed data indicated that there was not a significant difference between the two sets of scores.

An Analysis of Variance (ANOVA) was used to determine whether the differences in the data were related to the treatment effect or simply by chance. An alpha of .05 was used to evaluate the data.

The assumptions of ANOVA were evaluated. The assumption of independence and normality were satisfied for the posttest. Levene's test of homogeneity of variance required a transformation of data in order to be satisfied, $p = .302$, $p > .05$. Data will be given for the ANOVA both before and after arcsine transformation.

The ANOVA indicated that there is no statistically significant difference in the instructional methods of traditional ($M = -.17$, $SD = .67$, $n = 20$) and Problem-Based Learning ($M = -.35$, $SD = .58$, $n = 20$) with the posttest (See Table 13), $F(1, 38) = .80$, $p > .05$, $p = .376$ (See Table 14).

Table 13: Descriptives for Instructional Methods

	Instructional Method	N	Mean	Std. Deviation
Pretest	Traditional	20	51.60	8.38
	PBL	20	57.15	10.61
Posttest	Traditional	20	-.17	.67
	PBL	20	-.35	.58
Group Presentation	Traditional	20	-.22	.36
	PBL	20	.03	.29

Table 14: Analysis of Variance for Instructional Methods

Source	df	<i>F</i>	<i>p</i>
Between subjects			
Posttest	1	.80	.376
Group	1	.61	.02*
Presentation			
Source	df	<i>F</i>	<i>p</i>
Within subjects			
Posttest	38		
Group	38		
Presentation			

* $p < .05$

Non-transformed data (original) support the findings of the transformed data. There is no statistically significant difference in the students' posttest scores for the instructional methods of traditional ($M = 82.45$, $SD = 10.20$, $n = 20$) and Problem-Based Learning ($M = 74.20$, $SD = 15.86$, $n = 20$) (See Table 15), $F(1,38) = 3.83$, $p > .05$, $p = .058$ (See Table 16).

Table 15: Descriptives for Instructional Methods (non-transformed data (original))

	Instructional Method	N	Mean	Std. Deviation
Pretest	Traditional	20	51.60	8.38
	PBL	20	57.15	10.61
Posttest	Traditional	20	82.45	10.20
	PBL	20	74.20	15.86
Group Presentation	Traditional	20	90.40	9.32
	PBL	20	92.35	5.28

Table 16: Analysis of Variance for Instructional Methods – non-transformed data (original)

Source	df	<i>F</i>	<i>p</i>
Between subjects			
Posttest	1	3.83	.058
Group Presentation	1	.66	.421
Source	df	<i>F</i>	<i>p</i>
Within subjects			
Posttest	38		.
Group Presentation	38		.

* $p < .05$

Observed power for the transformed data was 14. With 80 indicating good power, 14 is a weak power. This suggests a strong possibility of failure to correctly reject a false null hypothesis. Observed power for the non-transformed data (original) was 48. The power of the non-transformed data (original) is still considered weak, 80 being the standard by which power is determined. There is a strong possibility that there will be a failure to correctly reject a false null hypothesis.

The ANOVA was used to evaluate the data of the group presentation assessment also. The alpha was .05. The ANOVA assumptions were evaluated for the group presentation assessment. Levene's test of homogeneity of variance required that the data be transformed in order to be satisfied, $p = .539$, $p > .05$. Arcsine transformation was performed. Again, the assumption of normality was never satisfied.

As determined in the *t*-test, conflicting results occurred in the group presentation assessment. The transformed data indicated that there was a statistically significant difference between the methods of instruction, $F(1, 38) = .61$, $p < .05$, $p = .02$ (See Table 14). Student achievement was different between the methods of traditional instruction

($M = -.22$, $SD = .36$, $n = 20$) and Problem-Based Learning ($M = -.03$, $SD = .29$, $n = 20$) (See Table 13) on group presentation. Students in the PBL class scored higher than those in the traditional classroom on the group presentations. The observed power was 64, and that indicates a medium power. Failure to reach 80 suggests that there might be a failure to correctly reject a false null hypothesis.

The non-transformed data (original) indicated that there was no statistically significant difference between the methods of instruction, $F(1, 38) = .66$, $p > .05$, $p = .421$ (See Table 16) on the group presentation. Students learning with traditional instruction ($M = 90.40$, $SD = 9.32$, $n = 20$) performed as well as those using Problem-Based Learning ($M = 92.35$, $SD = 5.28$, $n = 20$) (See Table 15) on the group presentation. The observed power was 13. This is weak power.

There was a conflict between the results of the transformed data and the non-transformed data (original) for the group presentation. The transformed data indicated that there was a statistically significant difference between the methods of instruction while the non-transformed (original) data showed there was no statistically significant difference.

Before beginning the Analysis of Covariance (ANCOVA) for the purpose of determining whether prior knowledge impacted the test results for the posttest or group presentation, a one-way ANOVA was run comparing posttest and pretest scores. Running the ANOVA at alpha .05, no significant difference in the scores was found, $p = .058$, $p > .05$. A one-way ANOVA was also run comparing the group presentation assessment scores with the pretest scores. Again no significant differences were found in the scores,

$p = .421, p > .05$. This indicated that the covariate of pretest would have no impact on the outcome of the analysis; there was no relationship found between prior knowledge and the posttest or group presentation scores. No further analysis was done.

Summary of Research Project

This research design was quasi-experimental. A pretest-posttest was used with the publisher-produced instrument. A researcher-designed group presentation was used to score the group presentations. There was no statistically significant difference between the two methods of instruction when using the written posttest scores.

The analysis for the group presentation assessment was mixed. The non-transformed data (original) indicated that there was no statistically significant difference in student achievement for the two methods of instruction. However, the transformed data indicated that there was a statistically significant difference in student achievement for the two methods of instruction. The power of the non-transformed data (original) is stronger than the power of the transformed data indicating that there is less likely a chance of falsely rejecting the null hypothesis when following the non-transformed data (original) findings.

The group presentation scores were not as definitive in their results. There is a conflict of analysis results. The strength of the power of the non-transformed data (original) indicates that it is more likely to reflect the correct results of analysis.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter consists of three sections. The first section is a summary of the study under investigation. The next section contains a discussion of the findings and conclusions of the study. The last section contains recommendations developed based on the findings of the study.

Summary

The purpose of this study was to determine whether Problem-Based Learning method of instruction is as effective as traditional instruction in fifth-grade social studies classes for student achievement. In conjunction with the study on the social studies classes, a pilot study was conducted in science prior to beginning the study.

The research design for the study was quasi-experimental. A pretest-posttest was used to gather data. A researcher-designed group presentation assessment was used to score the group presentations. Data were collected from 88 fifth-grade students in an urban private school: 44 involved in the science study, 44 participating in the social studies study. Data included scores from a pretest, a posttest, and a group presentation for all participants.

The posttest and group presentation scores were used in analysis as the dependent variables. Analysis was run on the dependent variables separately. The independent variable was the teaching methods, and the pretest scores were used as a covariate in the ANCOVA. Data analysis included the *t*-test, ANOVA, and ANCOVA.

For the science pilot study, the *t*-test, ANOVA, and ANCOVA indicated that there was a significant difference between the teaching methods for student achievement. Although both groups made gains, those taught traditionally made significantly greater gains than those taught using Problem-Based Learning.

The social studies research project yielded different results than the pilot study. With the posttest analysis results, the findings indicated that there was no significant difference in student achievement between the two instructional methods. The results of the group presentation scores were mixed. The original data indicated no significant difference in student achievement between the two instructional methods. The transformed data indicated that there was a significant difference in student achievement between the two instructional methods. Those students taught traditionally scored significantly higher than those taught with PBL.

Conclusions

The conclusions section will be presented in three parts. The three parts consist of: the pilot study, the research study, and summary.

Pilot Study – Science Case

Based upon the study findings for the pilot study, students appeared to gain more knowledge through the use of traditional instruction rather than Problem-Based Learning. The work of Mergendoller, Bellisimo, & Maxwell (2001) with high school students indicated that there was no significant difference between those students using traditional instruction and those using PBL. Their work did, however, recognize that those taught traditionally did have a greater positive acquisition of knowledge than did those using Problem-Based Learning. Since there was a significant difference in student achievement in the science study, these findings may indicate that PBL may not be as successful with elementary children as it is with older students. Elementary education provides opportunities to build foundations for future learning. Findings may indicate that without the foundations upon which to build, PBL may not be as successful in student achievement as traditional instruction.

However, the student presentations indicated a difference in the learning process between those using PBL and those receiving traditional instruction. The presentations of the PBL students included materials that went beyond the textbook information and gave them a broader view of the subject matter than they would have studied. The science students using PBL investigated temperature and the need for soil when considering the needs of plants for growth.

Research Study – Social Studies Case

The findings of the social studies research project were different from the pilot study. The findings for this research project using the posttest scores indicated that there

was no significant difference in student achievement between the teaching methods. This is supported by the study of Mergendoller, Bellisimo, & Maxwell (2001) with high school students who compared traditional instruction and Problem-Based Learning. They found that there was no significant difference between the instructional method of traditional and PBL.

The group presentation scores provided conflicting data results. The original scores indicated no significant difference in student achievement between traditional instruction and Problem-Based Learning. The transformed data showed a significant difference in student achievement. An examination of the means in the original data shows the means as being basically the same. This may explain the conflicting results of the data analysis. Additionally, scoring error may have occurred as the person scoring the group presentation was constrained by time during the presentation process. Again, however, the students using PBL went beyond the textbook and demonstrated a greater understanding of the importance of considering other nations being influential on the world than just those selected by the authors of the text. Class discussion was held and the decision was made by the students to define ancient kingdoms as those existing Before Christ. The students incorporated more kingdoms in their study than were expected by the authors.

Conflicting findings between the pilot study and the research study may be explained by the different subject matter used. Subject availability prevented the two studies from being conducted in the same subject. Based upon the school's schedule, one-half of the available students had already completed the social studies chapter prior to the

commencement of this research project. Also, small group size may also have impacted the findings of both studies.

Summary of Conclusions

The pilot study in science indicated that PBL might not be as successful with elementary students as far as student achievement is concerned; however, the indication that the students involved in PBL were going beyond the textbook-directed materials to investigate areas not presented to them indicates that the PBL process encouraged thinking and the PBL process provided opportunities for utilization of organization skills, group work, and decision-making.

With the findings of the 20th century concerning the brain, the way learning takes place, thinking skills, and the skills that will be needed for success in the 21st century, PBL may provide an opportunity to incorporate many skills which will make the workers of the future better prepared for contributing to the world in which they will live. Although the study in science did not indicate as great an improvement in achievement, the PBL process did provide the students with academic achievement in the study on plants.

The study in social studies indicated that there was no significant difference in the gains of student achievement between those learning traditionally and those learning through PBL. Each group was successful in learning. However, using decision-making skills, students involved in PBL went beyond the limits of the textbook and studied areas of their topic that were significant to the question to which they were to provide an answer. The students challenged themselves through the group work to go beyond the

realms of the text and include other areas that would impact their solution to the problem presented to them. The findings indicate that not all subject matter may be conducive to PBL. Educators should explore the use of PBL in different curriculums to find which produce the most successful results. The findings support the statements of Johnson and Finucau (2000) that encourage the benefit of incorporating PBL with didactic instruction at the elementary level.

Some reasons for the differences in the findings might be that the students involved in social studies built on materials already learned in chapters one and two. Although new material was added through the study in the third chapter, some of the information was also review from chapters one and two. Students in the science classes had not received any information about plants since studying them in grade three. Additionally, time constraints for the assistant principal, when assessing the social studies presentations, may have influenced the outcomes of the assessment scores.

The question becomes—what is the goal of education and educators? If the goal of education is to provide a gain in student achievement through learning facts, then traditional instruction provides the best opportunity to be successful according to the pilot study. If, however, the goal of education is to provide a means to learn as well as a gain in student achievement, then Problem-Based Learning provides a venue through which this can be successfully achieved. The incorporation of decision-making, group work, thinking skills, and a challenge to learn through active participation are all part of Problem-Based Learning. Research from the 20th century indicates that students preparing for the 21st century must go beyond the boundaries of basic facts and must

indeed learn how to think, make decisions, work in groups, and be active participants of learning throughout their lives if they are going to be successful.

Recommendations for Practice

The following recommendations are based on the study's findings:

1. It is recommended that PBL be included as an instructional method in the elementary classroom. Although not all curriculums may be conducive to the PBL process, the PBL process provides a rich environment in which children determine what is to be learned and investigate the facts themselves. Incorporating PBL into the classroom will enrich the learning environment and provide opportunities for children to become more active learners and to take on more responsibility for their learning.

2. It is recommended that at the elementary level, PBL be introduced at the whole group level prior to dividing into smaller groups. This provides an opportunity for an understanding of the process.

3. It is recommended that elementary instructors explore the incorporation of PBL into their curriculum in order to find successful ways of using PBL.

Recommendations for Future Research

No previous studies were found comparing Problem-Based Learning and traditional instruction at the elementary level. This study adds to the literature in this area. Based on the findings of this study, the researcher made the following recommendations for future research:

1. Further study could be conducted to determine the impact of Problem-Based Learning on elementary students' academic achievement.
2. Further study could be done using different independent variables including age, gender, ethnicity, or socioeconomic factors.
3. Qualitative aspects of research could provide important insights into the attitudes of teachers, parents, and students on the success of Problem-Based Learning as an instructional method and on the knowledge gained through the process.
4. Longitudinal studies should be conducted to discover the long-term effects of using Problem-Based Learning in preparation for future employment. Does PBL better prepare workers of the future through developing a process of learning than traditional instruction?

Although the findings of this study were inconclusive concerning the effectiveness of PBL on student achievement, further studies could explore other variables which educators might consider incorporating as a strategy to teach 21st century skills.

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APPENDIX A
PRESENTATION RUBRIC AND DEFINITIONS

Rubric for Presentation

Topic	4 points Exceptional	3 points Expected	2 points Limited	1 point Some Effort	0 points No Effort
Introduction					
Content					
1. Fact					
Detail					
Detail					
2. Fact					
Detail					
Detail					
3. Fact					
Detail					
Detail					
4. Fact					
Detail					
Detail					
5. Fact					
Detail					
Detail					
6. Fact					
Detail					
Detail					
Conclusion					
Use of Technology					
Participation in Presentation					
Number of Sources Used					
TOTAL POINTS					
GRADE					

Rubric Definitions

Topic	Exceptional 4 points	Expected 3 points	Limited 2 points	Some Effort 1 point	No Effort 0 points
Introduction	<ul style="list-style-type: none"> Names Explanation of project 	<ul style="list-style-type: none"> Names 2 sentence summary of project 	<ul style="list-style-type: none"> Names 1 sentence summary of project 	<ul style="list-style-type: none"> Names 	No effort visible
Content	<ul style="list-style-type: none"> Fact Explanation of what was learned 	<ul style="list-style-type: none"> Fact 2 details 	<ul style="list-style-type: none"> Fact 1 detail 	<ul style="list-style-type: none"> Fact 	No effort visible
Conclusion	<ul style="list-style-type: none"> Summary of findings – 3-4 sentences explaining relevancy of findings Recommendation 	<ul style="list-style-type: none"> Summary of findings –3-4 sentences Recommendation 	<ul style="list-style-type: none"> Summary of findings – 1 –2 sentences Recommendation 	<ul style="list-style-type: none"> Summary of findings No recommendation 	No effort visible
Use of Technology	<ul style="list-style-type: none"> Used 4 times 	<ul style="list-style-type: none"> Used 3 times 	<ul style="list-style-type: none"> Used 2 times 	<ul style="list-style-type: none"> Used 1 time 	Not used
Participation in Presentation	<ul style="list-style-type: none"> Presentation participation includes all members 	<ul style="list-style-type: none"> Presentation participation limited to 4 members 	<ul style="list-style-type: none"> Presentation participation limited to 3 members 	<ul style="list-style-type: none"> Presentation participation limited to 2 member 	Presentation participation limited to 1 member
Number of sources	<ul style="list-style-type: none"> 4 resources used 	<ul style="list-style-type: none"> 3 resources used 	<ul style="list-style-type: none"> 2 resources used 	<ul style="list-style-type: none"> 1 resource used 	No sources

Bonus Points:

Creativity – went beyond the information presented in the book (4 points)

Organization – presentation flows easily from introduction, to content, to conclusion (4 points)

Additionally, each group will have an opportunity to “grade” each member on participation during the learning and presentation processes.

APPENDIX B
SCIENCE CASE

NASA has been exploring the planet Mars. They have two robotic vehicles that are collecting data and transmitting their findings back to earth. One possibility for the findings might be to discover whether or not life could be sustained on Mars. You and your group have been commissioned to determine exactly what is necessary to sustain plant life on Mars so that people would have a food supply. You are to research data and present your findings to the project director.

APPENDIX C
PERMISSION FROM MISSISSIPPI STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD



January 20, 2005

Ann Scott
622 Muirwood Circle
Ridgeland, MS 39157

Re: IRB Docket #04-328: What Now, Now That We Are Wired? - A Study on Problem-Based Learning Versus Traditional Instruction in Fifth Grade Social Studies Classes

Dear Ms. Scott:

The above referenced project was reviewed and approved via expedited review for a period of January 18, 2005 through January 15, 2006 in accordance with 45 CFR 46.110 #7. Please note the expiration date for approval of this project is January 15, 2006. If additional time is needed to complete the project, you will need to submit a Continuing Review Request form 30 days prior to the date of expiration. Any modifications made to this project must be submitted for approval prior to implementation. Forms for both Continuing Review and Modifications are located on our website at <http://www.msstate.edu/dept/compliance>.

Any failure to adhere to the approved protocol could result in suspension or termination of your project. Please note that the IRB reserves the right, at anytime, to observe you and any associated researchers as they conduct the project and audit research records associated with this project.

Please refer to your docket number (#04-328) when contacting our office regarding this project.

We wish you the very best of luck in your research and look forward to working with you again. If you have questions or concerns, please contact me at 325-3294 or at tarwood@research.msstate.edu.

Sincerely,

Tracy S. Arwood
Director

cc: Connie Forde

Office for Regulatory Compliance

P. O. Box 6223 • 8A Morgan Street • Mailstop 9563 • Mississippi State, MS 39762 • (662) 325-3294 • FAX (662) 325-8776

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Procedural Modification/Addendum Request Form

Please note: This form may NOT be used for personnel changes or time extensions.
Please complete a Personnel Modification form for personnel changes or a Continuing Review Request form for time extension requests.

IRB Docket #04-328

Principal Researcher/Investigator: Ann W. Scott

Research Title: A Study on Problem-Based Learning Versus Traditional Instruction in Fifth Grade Social Studies Classes (A reduction of title name)

1. Summarize / Itemize requested changes and justification for each.

At the request of my committee, a pilot study will be included in my research project. The pilot will be conducted in a science class for the purpose of reviewing the process of my study. One purpose of the pilot will be to validate the rubric that will be used during the study.

At the request of my committee, I will be removing the data collection for retention, gender, student achievement, and the qualitative parts of the original study. The purpose of this change is to reduce the variables in the study to make it more fine-tuned towards discovering the differences in the two teaching methods.

In order to accommodate the pilot, the material that will be taught in the research project will change from chapter 2 on Egypt to chapter 3 on Kingdoms & Empires. The change of topic will allow the children in the social studies classes to proceed in their studies while the pilot study is being conducted.

2. Do changes require a REVISED CONSENT statement or procedure? *If so, attach revised form and procedures.*

Yes. They are attached.

3. Do changes require revisions to the assessment of risk of harm to the subjects? *If so, attach revisions.*

No.

4. Do changes require revisions to the methods of ensuring anonymity or confidentiality? *If so, explain.*

No.

Signature of Researcher/Investigator:
Ann W. Scott

Date:
February 2, 2005

Signature of Advisor (if student):
Connie Forde

Date:
February 2, 2005

Version February 2003

APPENDIX D

PARENTAL CONSENT AND MINOR ASSENT FORMS - SCIENCE

Parental Informed Consent Document

Title of Study: A pilot study in science for: A Study on Problem-Based Learning Versus Traditional Instruction in Fifth Grade Social Studies Classes

Investigators: Ann W. Scott
Mississippi State University Doctoral Student

Study Site: School in Southeast

What is the purpose of this research project?

The purpose of a pilot study is to allow for a “dress rehearsal” for researcher. The purpose of this study is to research whether or not teaching methods enhance student learning, motivates students to be more involved in the learning process and encourages a higher level of achievement by the learners.

How will the research be conducted?

The study will be conducted over a 4 week time period. Students will participate in the study during their regularly scheduled class periods of 30 minutes a day, 4 days a week. In addition, homework assignments may be given which would require an additional 20-30 minutes of work at night. Homework assignments will not be given every night.

The study will consist of two groups. One group will use traditional methods of learning – using the textbook and study questions. The other group will use the textbook as resource materials but the lessons will be taught using Problem-Based Learning techniques. Students will work in small groups to determine goals of learning, research answers, and to create their presentations. Students will also be free to use the Internet to research materials to complete their learning goals.

Your child will be assigned to a group who will have the responsibility to share with the class what they have learned through their study. Both classes will be responsible for making a group presentation to their class.

Are there any risks or discomforts to my child because of my participation?

There are no risks or discomforts associated with this study.

Does participation in this research provide any benefits to others or my child?

I feel that the benefit of this study will be to show that using problem-based learning helps learners achieve higher, remember longer what was learned, and encourage greater participation in the learning process by the learner.

Will this information be kept confidential?

All information from this study will be kept confidential. Only the researcher and project supervisor will have access to the data collected for this study. The data will be coded in such a way that the child’s name will be separated from the results of all data collected. Also, please note that these records will be held by a state entity and therefore are subject to disclosure if required by law.

Who do I contact with research questions?

If you should have any questions concerning this research project, please feel free to contact Ann Scott at (601) 355-1731. For additional information regarding human participation in research, contact the Mississippi State University Regulatory Compliance Office at (662) 325-0994.

What if my child does not want to participate?

Please understand that your child's **participation is voluntary**, your **refusal to participate will involve no penalty or loss** of benefits to which you are otherwise entitled, and you **may discontinue your child's participation** at any time without penalty or loss of benefits. Your child will continue to be a part of the teaching experience, but I will not include any data from your child.

You will be given a copy of this form for your records.

Participant Signature

Date

Investigator Signature

Date

Minor Assent Document

Project Title: A pilot study for: A Study on Problem-Based Learning Versus Traditional Instruction in Fifth Grade Social Studies Classes

Investigator: Ann W. Scott
Mississippi State University Doctoral Student

I would like your help. Many of you know that I am going to school at Mississippi State University. I am beginning work on a project to help me learn about different teaching methods when using the computer in the classroom. I want to know if different teaching methods help children to learn better, remember more about what they learned, and participate more in the learning process

I will be teaching you a unit on plants that is part of your regular fifth grade studies. We will meet during your regular science time of 30 minutes a day, 4 days a week, for 4 weeks. Homework assignments may be given which will take an extra 20-30 minutes at night. Homework assignments will not be given every night.

The study will have two groups. One group will use traditional methods of learning – using the textbook and study questions. The other group will use the textbook and workbook as resource materials but the lessons will be taught using Problem-Based Learning techniques. Students will work in small groups to determine goals of learning, research answers, and to create their own presentations.

All students will be asked to participate in a group presentation to share what you have learned during our study at the conclusion of our study.

Not everyone who takes part in this study will get something out of it. I feel that this study will be to show that different teaching methods may help you do better with grades, remember longer what was learned, and be more motivated to participate in learning.

It is up to you whether or not you want to join this study. If you do not want to be a part of this research study, it will not affect your grade in this class. You do not have to be in this study if you do not want to be. Your grade will not be lowered if you decide to stop after we begin. You will continue to come to class, but I will not use any of your information for my project.

If you decide to be in this study, please sign your name.

I, _____, want to participate in this research study.
(Print your name here)

(Sign your name here)

(Date)

APPENDIX E
PILOT STUDY – TRADITIONAL LESSON PLANS

Traditional Lesson Plans
Plants

Week #1	Week #2	Week #3	Week #4
Explanation of project	Check questions Read pages 86 - 89 & discuss	Work in groups	Presentation Group #1 Presentation Group #2
Read pages 70 - 72 & discuss Answer questions 1 - 2	Read pages 90 - 91 & discuss Assign project	Work on presentation	Presentation Group #3 Presentation Group #4 (Copy of groups 1 - 2 distributed)
Check questions 1 - 2 Read pages 78 - 79 & discuss	Read pages 92 - 94 Answer questions 1 - 2 Work in groups	Work on presentation	Presentation Group #5 (Copy of groups 3 - 4 distributed)
Read pages 80 - 83 & discuss Answer questions 1 - 2	Check questions Work in groups	Work on presentation	(Copy of group 5) (Written test on Tuesday)

APPENDIX F
PRESENTATION GUIDELINES

Guidelines for presentation:

The goal of the presentation is to share with the class the knowledge your group has gained through researching. Your group will have 15 minutes to share with the class what you learned.

Your presentation will be counted as a test grade this term in science. Each person in your group is expected to participate in the creating and the presenting of your project.

Your presentation should include the following areas:

(To be determined by the groups)

Your presentation should cover these parts, but do not just name what you learned. Your presentation should include details about each of these areas, too. Be specific in what you discuss. Add additional information orally to what is seen – in other words, don't put everything you know on the slides you show. Add more information orally as you give your report.

APPENDIX G

PILOT STUDY – PROBLEM-BASED LEARNING LESSON PLANS

Problem-Based Learning – Lesson Plans Plants

Week #1	Week #2	Week #3	Week #4
Explanation of project and pretest	Questions' section (continue in collaborative group)	Research learning objectives (Work with collaborative groups) Add to Resource list <i>Write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)</i>	Presentation Group #1 Presentation Group #2 Presentation Group #3
Begin case (reader, recorder) Data section <i>Write in journal about process followed and your evaluation of the process</i>	Demo Learning Objectives Develop Learning Objectives from questions <i>Write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)</i>	Research learning objectives (Work with collaborative groups) Add to Resource list	Presentation Group #4 Presentation Group #5 (Copy of groups 1 - 3 distributed)
Assign small groups Prior knowledge of what sustains life – record as large group	Develop Learning Objectives from questions As a large group, determine Resource list <i>Write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)</i>	Work on presentation with group <i>Write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)</i>	(Copy of groups 4 - 5 distributed)
Questions' section (begin in large group) <i>Write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)</i>	Begin research on learning objectives (Work with collaborative groups) Add to Resource list	Work on presentation with group	Written Content test

APPENDIX H
SCIENCE - PBL WORKSHEET

Science – Plants

Data from problem	Questions	Learning Goals	Findings	Resources

APPENDIX I
SOCIAL STUDIES CASE

The curator (head person) of your local museum has been directed by the museum board to create an exhibit of ancient kingdoms and empires and their contributions to the world. The curator has commissioned you and your company with researching, recommending and defending your choices in a presentation to the board.

APPENDIX J
PARENTAL CONSENT AND MINOR ASSENT FORMS

Parental Informed Consent Document

Title of Study: A Study on Problem-Based Learning Versus Traditional Instruction in Fifth Grade Social Studies Classes

Investigators: Ann W. Scott
Mississippi State University Doctoral Student

Study Site: School in Southeast

What is the purpose of this research project?

The purpose of this study is to research whether or not teaching methods enhance student learning, motivates students to be more involved in the learning process and encourages a higher level of achievement by the learners.

How will the research be conducted?

The study will be conducted over a 6 week time period. Students will participate in the study during their regularly scheduled class periods of 30 minutes a day, 4 days a week. In addition, homework assignments may be given which would require an additional 20-30 minutes of work at night. Homework assignments will not be given every night.

The study will consist of two groups. One group will use traditional methods of learning – using the textbook, study questions, and a workbook with traditional uses of technology – PowerPoint presentations for review and Internet access to specified sites. The other group will use the textbook and workbook as resource materials but the lessons will be taught using Problem-Based Learning techniques. Students will work in small groups to determine goals of learning, research answers, and to create their presentations. Students will also be free to use the Internet to research materials to complete their learning goals.

I will be giving a written pretest and posttest on the topic of Kingdoms & Empires, a part of the students' regular social studies curriculum. The pretest will determine their knowledge of Ancient Kingdoms & Empires before we begin the study. The posttest will be given at the completion of our study. Additionally, your child will be assigned to a group who will have the responsibility to share with the class what they have learned through their study.

Are there any risks or discomforts to my child because of my participation?

There are no risks or discomforts associated with this study.

Does participation in this research provide any benefits to others or my child?

I feel that the benefit of this study will be to show that using problem-based learning helps learners achieve higher, remember longer what was learned, and encourage greater participation in the learning process by the learner.

Will this information be kept confidential?

All information from this study will be kept confidential. Only the researcher and project supervisor will have access to the data collected for this study. The data will be coded in such a way that the child's name will be separated from the results of all data collected. Also, please note that these records will be held by a state entity and therefore are subject to disclosure if required by law.

Who do I contact with research questions?

If you should have any questions concerning this research project, please feel free to contact Ann Scott at (601) 355-1731. For additional information regarding human participation in research, contact the Mississippi State University Regulatory Compliance Office at (662) 325-0994.

What if my child does not want to participate?

Please understand that your child's **participation is voluntary**, your **refusal to participate will involve no penalty or loss** of benefits to which you are otherwise entitled, and you **may discontinue your child's participation** at any time without penalty or loss of benefits. Your child will continue to be a part of the teaching experience, but I will not include any data from your child.

You will be given a copy of this form for your records.

Participant Signature

Date

Investigator Signature

Date

Minor Assent Document

Project Title: A Study on Problem-Based Learning Versus Traditional Instruction in Fifth Grade Social Studies Classes

Investigator: Ann W. Scott
Mississippi State University Doctoral Student

I would like your help. Many of you know that I am going to school at Mississippi State University. I am beginning work on a project to help me learn about different teaching methods when using the computer in the classroom. I want to know if different teaching methods help children to learn better, remember more about what they learned, and participate more in the learning process

I will be teaching you a unit on Kingdoms & Empires that is part of your regular fifth grade studies. We will meet during your regular social studies time of 30 minutes a day, 4 days a week, for 5-6 weeks. Homework assignments may be given which will take an extra 20-30 minutes at night. Homework assignments will not be given every night.

The study will have two groups. One group will use traditional methods of learning – using the textbook, study questions, and a workbook. The other group will use the textbook and workbook as resource materials but the lessons will be taught using Problem-Based Learning techniques. Students will work in small groups to determine goals of learning, research answers, and to create their own presentations.

I will be asking for some information from you. I will be asking what you what you know about Kingdoms & Empires by giving you a pretest (a test before we begin) and a posttest (a test after we have studied Kingdoms & Empires). Additionally, all students will be asked to participate in a group presentation to share what you have learned during our study.

Not everyone who takes part in this study will get something out of it. I feel that this study will be to show that different teaching methods may help you do better with grades, remember longer what was learned, and be more motivated to participate in learning.

It is up to you whether or not you want to join this study. If you do not want to be a part of this research study, it will not affect your grade in this class. You do not have to be in this study if you do not want to be. Your grade will not be lowered if you decide to stop after we begin. You will continue to come to class, but I will not use any of your information for my project.

If you decide to be in this study, please sign your name.

I, _____, want to participate in this research study.
(Print your name here)

(Sign your name here)

(Date)

APPENDIX K
LESSON PLANS – TRADITIONAL

Traditional Teaching – Lesson Plans
Chapter 3 – Kingdoms & Empires

Week #1	Week #2	Week #3
Explanation of project and pretest	Read pages 67 (bottom) – 68 (top) & discuss Assign: answer questions 26-32	Read pages 68-71 (middle)& discuss Assign: answer questions 33-43 & learn terms 16-21
Read pages 62 – 63 & discuss Answer questions 1-7, 9-12 Look at geography mastery 1 Assign: complete questions and learn terms 1-7	Check questions Summarize using PowerPoint Work map 11 Assign: review terms 1-15; review geography mastery 1; review questions 1-32	Check questions Read pages 71-72 & discuss Review terms 1-21 Assign: answer questions 44-50 & study terms 1-21
Check questions Review terms 1-7 Read pages 64-65 (top) & discuss Answer questions 8, 13-17 Assign: complete questions and learn terms 8-15	Quiz 1	Check questions Summarize using PowerPoint Assign: study questions 1-50, study terms 1-21, review geography mastery 1
Check questions Read page 65 (bottom) – 67 (top) & discuss Answer questions 18-25 Assign: complete questions and review terms 1-15	<u>Locate on map 4</u> France, Spain, England, Portugal, Turkey, Italy, Greece, Sweden, Norway, Russia, China, India, Egypt, Iran, Japan, Saudi Arabia, Germany Review map 3	Quiz 2

Week #4	Week #5	Week #6
<p>Read pages 73-75</p> <p>Answer questions 51-61</p> <p>Assign: complete questions and learn terms 22-28</p>	<p>Check questions</p> <p>Summarize using PowerPoint</p> <p>Assign: study questions 1 – 73, terms 1 – 28, geography mastery 1, maps 1-4, 11</p>	<p>(Copy of groups 4 & 5 distributed)</p> <p>Assign: study questions 1 – 73, terms 1 – 28, geography mastery 1, maps 1-4, 11</p>
<p>Check questions</p> <p>Locate on map 2 – Lydia, Greece, Jerusalem, Persian Gulf, Caspian Sea, Mt. Ararat, Mediterranean Sea, Aegean Sea, Black Sea, Carthage, Phoenicia, Asia Minor, Sinai Peninsula</p>	<p>Quiz 3</p> <p>Presentation: Group 1</p> <p>Assign: study questions 1 – 73, terms 1 – 28, geography mastery 1, maps 1-4, 11</p>	<p>Play game to review</p> <p>Assign: study questions 1 – 73, terms 1 – 28, geography mastery 1, maps 1-4, 11</p>
<p>Read pages 75-78</p> <p>Answer questions 62-68</p> <p>Assign: Review questions 1-68 and terms 1-28</p>	<p>Presentation: Group 2</p> <p>Presentation: Group 3</p> <p>(Copy of group 1 distributed)</p>	<p>Assign: Test on Chapter 3, Kingdoms & Empires</p>
<p>Read page 79 & discuss</p> <p>Assign: answer questions 69-73 & learn terms 41-51</p>	<p>Presentation: Group 4</p> <p>Presentation: Group 5</p> <p>(Copy of groups 2 & 3 distributed)</p>	<p>Test on Chapter 3 – Kingdoms & Empires</p>

APPENDIX L

LESSON PLANS – PROBLEM-BASED LEARNING

Problem-Based Learning – Lesson Plans

Chapter 3 – Kingdoms & Empires

Week #1	Week #2	Week #3
Explanation of project and pretest	Questions' section (continue in collaborative group)	Begin research on learning objectives (Work with collaborative groups) Add to Resource list
Begin case (reader, recorder) Data section Homework: write in journal about process followed and your evaluation of the process	Questions' section (continue in collaborative group) Homework: write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)	Research learning objectives (Work with collaborative groups) Add to Resource list Homework: write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)
Assign small groups Prior knowledge of Ancient Middle East empires – record as large group	Demo Learning Objectives Develop Learning Objectives from questions	Research learning objectives (Work with collaborative groups) Add to Resource list
Questions' section (begin in large group) Write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)	Develop Learning Objectives from questions As a large group, determine Resource list Write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)	Research learning objectives (Work with collaborative groups) Write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it) Add to Resource list

Problem-Based Learning – Lesson Plans
Chapter 3 – Kingdoms & Empires

Week #4	Week #5	Week #6
Work on presentation with group	Presentation: group 2 (Copy of group 1 distributed)	Homework assignment: Test on Chapter 3 – Kingdoms & Empires
Work on presentation with group Homework: write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)	Presentation: group 3 (Copy of group 2 distributed)	Test on Chapter 3 – Kingdoms & Empires
Work on presentation with group	Presentation: group 4 (Copy of group 3 distributed)	
Work on presentation with group Homework: write in journal about process followed and your evaluation of the process (include what you did, why you did it, how you did it)	Presentation: group 5 (Copy of group 4 distributed)	
Presentation: group 1	(Copy of group 4 distributed)	

APPENDIX M
PROBLEM-BASED LEARNING WORKSHEET

Social Studies – Chapter 3, Kingdoms & Empires

Data from problem	Questions	Learning Goals	What you learned	Resources