COMPARISON OF STANDARDIZED TEST SCORES FROM TRADITIONAL CLASSROOMS AND THOSE USING PROBLEM-BASED LEARNING

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COMPARISON OF STANDARDIZED TEST SCORES FROM TRADITIONAL CLASSROOMS AND THOSE USING PROBLEM-BASED LEARNING

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ABSTRACT

This research compares differences between standardized test scores in problem-based learning (PBL) classrooms and a traditional classroom for 6th grade students using a mixed-method, quasi-experimental and qualitative design. The research shows that problem-based learning is as effective as traditional teaching methods on standardized tests. The most significant finding from this study is that the use of problem-based learning can increase standardized test scores at least as much as traditional teaching methods. This is true for initially low-scoring students and disadvantaged groups and when increasing higher-thinking skills is a classroom goal.

The mixed-method research design demonstrated differences in scores both between the experimental groups as an aggregate and within the groups on the pre- and posttests. The aggregate test score improvement over traditional teaching methods for the PBL group was very low. Improvement is so small it can be dismissed as unimportant. However, an additional regression analysis of test question levels of difficulty, defined by CTB (2002), provides more important results. When incorrect answers and corrected answers are compared, this analysis shows more students chose correct answers at higher levels of

difficulty for the PBL classrooms while the control classroom chose more correct answers at the lower levels of difficulty.

Overall, the research increases the body of knowledge about PBL because it compared PBL and traditional teaching relationships to achievement scores on standardized tests. Previous PBL research was also supported. The earlier research focused on qualitative studies that examine teacher classroom observations, opinions, and emphasize non-standardized assessments. The test score focus provides a unique and needed starting point for new research.

Approval Page

The faculty listed below, appointed by the Dean of the College of Graduate Studies, have examined a dissertation titled "Comparison of Standardized Test Scores from Traditional Classrooms and those using Problem-Based Learning," presented by Martha Elaine Needham, candidate for the Doctor of Philosophy Degree, and certify that in their opinion it is worthy of acceptance.

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CHAPTER I

INTRODUCTION

This research compared the standardized test scores from selected problem-based learning (PBL) classrooms with those from a selected traditional classroom in an effort to determine if there are differences between the teaching methods. The research is a mixed method study that adds to the body of knowledge on problem-based learning. This research specifically addresses the relationship between problem-based learning and standardized test scores.

Definition and Discussion of Problem-based Learning

PBL is defined as an instructional method that uses real-life problem-solving skills in situations that simulate real problems. It is also called experiential learning when used to teach adults (Torbert, 2004; Mintzberg, 2004; Argyris, 2008; Jackson, 1994). It is primarily a cognitive theory approach to learning that builds on multi-faceted, interdisciplinary, and linked learning from authentic, interdisciplinary, student-centered and cooperative learning settings (Jonassen & Land, 2000). Additional benefits associated with PBL according to advocates is the intention to change the way teachers approach learning by their students as well as to create the environment for the development of higher-level thinking skills. It differs from traditional teaching methods, because it is a *process-based* approach that sometimes uses other curriculum-based learning methods. Such process-based approaches can include Cooperative Learning (Kagan, 1994), Project-based Learning, Multiple Intelligences Theory (Gardner, 1993), and other popular teaching methods. Technology, using multimedia software, can also create opportunities for student-centered and multiple-intelligences learning approaches. While the intervention used in this research is low tech, it

introduces interactivity and highly visible public displays along with the electronic research assignments that demonstrate, "two characteristics of the new multimedia especially well-suited for active, collaborative student-centered learning that spans multiple intelligences" (Schrand, 2008, p. 84).

The accepted PBL design is to provide students with a complex problem with uncertain solution(s), diverse possible interpretations, and interdisciplinary or interacting systems (Rittel, 1984). While the PBL unit intervention to be used by this research has identifiable teaching method components, the process nature of the approach defines it as problem-based, not as a traditional teaching method although it will be referred to as a teaching method in the narrative. Paralleling some of Dewey's (1944) progressive ideas and those of contemporary curriculum and multicultural theory, the problem-based approach also moves away from the traditional educational concept that teachers are the transmitters of knowledge who teach it *to* students. According to problem-based learning advocates such as Rittel (1984), the traditional approach is limited because students learn to know the world as the teacher understands it rather than developing (or constructing) their own personal meaning.

On the other hand, the PBL criteria used to create the intervention used in this study was developed from the theories of Jonassen and Land (2000), Land and Hannafin (1996), Bereiter and Scardamalia (2005) and the suggestions by Ennis (1996). According to Jonassen and Land (2000), the fundamental change from traditional teaching to problem-based learning is characterized by three identifying criteria:

- Learning is a process of meaning making, not of knowledge transmission;
- Contemporary learning theorists focus increasingly on the social nature of this meaning process because humans are social creatures relying on each other for existence and personal beliefs; and
- The locus of knowledge or meaning is not in the head rather meaning is obtained through culture (Lave & Wenger, 1991, p. v) culminating in a requirement that learning environment is holistic, including culture, history, the environment, and other elements such as tools.

These six authors also note that since 1990 educational research has been increasingly interested in student-centered learning which has advocated "problem-based, inquiry-oriented pedagogies that lead to open-ended learning environments, cognitive apprenticeships, constructivists learning environments, micro worlds, goal-based scenarios, anchored instruction, social-mediated communication, etc.", according to Land & Hannafin (1996, p. 37). Prawat (1992) suggests that most teachers' beliefs are inconsistent about these inquiry-oriented and "constructivist approaches to teaching and learning" (p. 354). As a result, they may require rethinking and retraining. Bereiter and Scardamalia (2005) suggest that schools need to function as places where students become proficient in all aspects of knowledge, including the actual creation of knowledge. PBL is a method that enables learners to create knowledge through greater depth of understanding or acquired meaning and from which they can create knowledge to apply to new situations. These skills have been often defined as higher-level thinking. It moves the student from depending upon expert knowledge to that of the experimenter in control of his or her own knowledge. These abilities lead to comprehensive learning that moves beyond facts and into the development of critical or higher-level thinking. For example, the following summary from Ennis' (1996), *Teaching Critical Thinking: A Few Suggestions,* the essential characteristics of PBL:

1. Emphasize alternatives.

2. Emphasize seeking reasons and evidence. Ask, "Why?"

3. Emphasize others' points of view and open-mindedness.

4. Don't expect students to be subject matter experts.

5. Discuss questions without answers or that are controversial.

6. Give time to talk about the answers.

8. Get students to write down their positions, giving reasons to support their answers.

9. Get students to read each other's suggestions. Revise those answers.

10. Seek other devices to revise answers and papers before grading them.

11. Provide a set of criteria for judging written responses.

12. Transfer responsibility to students and let them use this in other situations.

Newer literature also recommends very similar characteristics using Socratic questioning to enhance critical thinking and is used extensively in the research intervention. Summarizing Paul and Elder (2008), the following types of questions are suggested as needed to develop critical thinking:

1. Ask for an example of a point a student or you have made.
2. Ask for evidence or reasons for a position.
3. Propose counter-examples.
4. Ask the group whether they agree.
5. Suggest parallel or similar examples.
6. Provide an analogy that illuminates a particular position.

7. Ask for a paraphrase of an opposing view.
8. Rephrase student responses clearly and accurately.

A major concern of American education today is measuring achievement by students in American schools. Teachers, politicians, and general consensus from recent comments reported by the media suggest that more needs to be done to raise achievement levels of particular populations, particularly those from poor, urban, bilingual, and minority homes. Solutions to low achievement by students in American public schools do not have simple answers because even the cause of the problem is as varied as are the student populations. For example, Darling-Hammond and Snyder (1992), and Gay (2000), point to the lack of achievement in American public schools by identified student populations. Yet others, such as Popham (in press) indicate that the research on student populations may be masking the most important correlation with low academic achievement—poverty!

The Research Question

The question for this research is whether a specific form of active learning, PBL, promotes higher standardized testing scores than does traditional classroom teaching methods. The question, showing statistical results of differences is answered quantitatively, initially, followed by qualitative coding and analysis to answer essential questions such as, why, how much, and when certain teaching methods make a difference. While differences demonstrated by statistical analysis are vital to determining what actually happened, the important qualitative sub-questions were needed to refine, detail and improve understanding of the results. These sub-questions include whether PBL can be seen as increasing relevance to students (or the ability of student's to tie new learning to prior knowledge), understanding, applicability, higher-level thinking skills, interest in learning, and, when

appropriately approached in the classroom may lead to increased involvement in their community. Additional sub-questions examined are ease of implementation, usability, and other pedagogical concerns that were directed to teachers, the classroom, the standards, and school district concerns. Qualitative instruments including teacher and student surveys, interviews, and collected student work were collected and coded to analyze these sub-questions. Issues seen as prominent have been detailed in the qualitative results using major themes charts, descriptive statics, direct quotes from participants in the narratives, and further detailed from classroom observations. Teacher's beliefs were also coded from survey answers and follow-up questions and comments during the study to identify major themes, classroom observation, and interviews and correlate them with the themes. Student level of engagement was obtained from classroom observation with video documentation and converted to an average time on task capable of being compared by team and group.

Obviously the issues outlined above cannot be entirely controlled in either the PBL classroom or in a traditional classroom. Yet, these issues may also impact standardized test results reported in the quantitative section. The qualitative findings were purposely used to further refine and explain the quantitative results. They do not validate or invalidate statistical validity nor do they influence interpretation of the statistics. However, in spite of the fact that they do not offer conclusive causal relationships, these issues provide comparison opportunities to educational theory contained in the literature review. Thus Chapter 5, the discussion of the overall mixed-method results, relates the research findings to the previously discussed literature. The process offers opportunities to discuss a number of potential causal relationships from the data based on these theories and set the stage for future research.

Theoretical Perspective

PBL is an educational process that builds upon and is consistent with a number of major learning theories including multiple intelligences, multicultural teaching practices, authentic learning approaches and cooperative learning. The PBL intervention in this study used social studies and geography as the focal disciplines in addition to four other disciplines: math, science, reading, and communication arts. This interdisciplinary application allows the researcher to easily separate PBL teaching methods that may also be used by a teacher in a traditional or control classroom from that of the PBL intervention classroom. Adopted state and national standards (Appendix 2) have been identified as measurements for dependent variables. They were correlated with standardized test questions already in use throughout the State of Missouri, using CBT's Classroom Connections to TerraNova, The Second Edition: A Resource Guide for Teachers (2002). TeraNova, published by CTB/McGraw-Hill (p. 8.2, Using Test Results), are:

> norm-referenced tests…(that) provide schools with information that compares student achievement with the performance of other students with similar grades across the country. The Reading and Language Arts, Mathematics, Science and Social Studies tests align with the standards of the National Assessment of Educational Progress (NAEP).

The filter or perspective used to interpret the data results is based on traditional standardized tests that have been based on benchmarks for schools established by the School Reauthorization of the Elementary and Secondary Education Act (NCLB) (2002) and the State of Missouri Standards (2004). Using these measurements as pre- and post-tests show the measurement of changes in student achievement. The qualitative portion of the research, however, is intended to further scrutinize and raise discussion on questions and answers that are not easily quantified. These data were collected using the personal interviews,

observation, and a survey (Appendices 5 and 6). The data is used to examine feelings, preferences, and other comments stemming from or influenced by standards and theories of best practices for teaching. The participant teacher was interviewed and observed by the researcher in an effort to obtain insights into her preferred teaching methods. As noted earlier, the participating teacher may already have been using teaching methodologies that have common characteristics with PBL. This was noted and follow up conversations and additional observation to clearly define differences were undertaken. Teacher observations, concerns, and quotes on each groups were coded to accurately reflect real differences in the PBL intervention classrooms and the control classroom using the teacher's understanding, experience, and feelings about classroom teaching.

Significance of the Research

The most significant finding from this study is that it has the ability to demonstrate that the use of problem-based learning (PBL) can increase standardized test scores at least as much as traditional teaching methods. This is may also be true for special student groups such as initially low-scoring students and disadvantaged groups and in situations where increasing higher-thinking skills is a classroom goal. Overall, the research increases the body of knowledge about PBL because it compared PBL and traditional teaching relationships to achievement scores on standardized tests. On a practical level this research supports the efforts of teachers who want to use PBL but who have fears that using the method may not provide the increase in standardized test scores required by their administrators.

The focus of this research is to evaluate the use of problem-based learning standardized test scores as compared to test results from traditional classroom methods. It

will also determine whether the differences in standardized tests can be shown for initially low-scoring students and disadvantaged groups and/or when increasing higher-thinking skills is a classroom goal. PBL is only one teaching methodology and is not being proposed as "the answer" to America's concern over student achievement. Because of its multi-component nature, the inclusion of diverse teaching methodologies, and its interdisciplinary approach, it has pedagogical potential that may lead beyond the research itself.

The overall issue of low academic achievement, however, cannot be answered by mere statistics. It also implies social and political perspectives. For example, the question is not only whether students test scores are lower, but also concern whether "every" student deserves or needs a "quality" education—and then defining what that means. Dewey (1944) through Ogbu (1994, 2003), Banks (1992), as well as Darling-Hammond and McCloskey (2008) points to the promise of a free education in America and suggest that "free" and "equal" or "quality" are synonymous.

While this research can provide data only on the impact of PBL on standardized test scores when compared to traditional teaching methods, the qualitative portion of the research is intended to increase the understanding of the statistical findings and may suggest political and social questions raised by these statistics. Improvement in standardized test scores demonstrated by PBL research can eliminate teachers' feeling that they must choose between using PBL or traditional teaching in the classroom and minimize the concern that student test scores will be negatively impacted.

So what is the significance to education in the creation of ever more difficult assessments? All students, regardless of social status, culture, race, or even academic standing need to prepare for productive lives. This requires the ability to make sense of the

world and knowing how to be successful in their own environment. Further, it means having the capability to make use of increasingly complex information that requires knowledge and the ability to use higher thinking skills from more than one discipline. The significance for education lies in the recognition that true learning may rest on individualizing information to create options, examples and choices from diverse resources. These can include civics education to teach both history and democratic preparation. Or, it can be the use of writing skills to the examination of civil rights to facilitate critical thinking.

Why A Social Studies Classroom?

Using a single-discipline oriented classroom for interdisciplinary teaching and learning raises questions about the emphasis on the other disciplines. Social studies classrooms are already defined as broad-based and interdisciplinary by the National Council on the Social Studies (1997). Interdisciplinary teaching may also be called "integrated". This research uses the term interdisciplinary instead of integrated to avoid any confusion. Thus, while PBL is, by definition an interdisciplinary teaching methodology; not all interdisciplinary learning is PBL.

However, the question, asked by Dewey (1933) and other progressive reformers beginning around the turn of the twentieth century, is whether an interdisciplinary approach to teaching can be shown to be a solution to increase student achievement. Applebee, Adler, and Filhan (2007) examined a number of approaches to interdisciplinary curricula, ranging from simple correlation of the disciplines to a major reconstruction of the disciplines taught. They found that interdisciplinary teaching, by itself, does not produce increased achievement. Instead, the methodology itself involves a number of "tradeoffs that need to be considered at the school site" (p. 1002). Further, teams that used the most reconstruction

of the traditional content were correlated to increased instructional approaches emphasizing engaging students. They also emphasized abstract projections and discussion of significant ideas. However, these teaching teams did not have a specific or more prevalent teaching methodology. In other words, PBL was not shown by this research to be any more effective than any of the other teaching methods "when interdisciplinary instruction is part of a larger package of 'best practices' that involved a student-centered pedagogy emphasizing cognitively engaging activities rare in contemporary classrooms" (Applebee, Langer, Nystrand, & Gamoran, 2003, p. 688).

Civic awareness and participation is vital to individuals and groups to obtain needed lifelong resources but questions remain regarding just what emphasis or perspectives need to be supported and emphasized in social studies. In other words, questions arise about not only *what* we are teaching but also *whom* we are teaching? Why are we teaching them? Apple (2004) asks whether or not there is a connection between the adopted curriculum in social studies and civic involvement while Thornton (2006) asked whether democratic education creates an increase in interest and engagement in the teachers as well as the students. Moreover, another question raised concerns the relationship, if any, made by teachers between democracy, social justice and education (Guttman, 1999; Regenspan, 2002). Carr (2008), reports when examining these issues that "…faculty members should make efforts…to more explicitly address democratic education in the courses, research and activities with education students, especially with a view to emphasizing a critical perspective of social justice…" and "…learning to teach precisely those students who populate our courses and not the 'ideal' students of progressive backgrounds we might wish we could be teaching…" (p. 131).

The awareness of both social justice and democracy rests on the ability to think critically and to link important facts from a number of disciplines to create viable options for dealing with a complex world. Hansen, Anderson, Frank, and Nieuwejaar (2008) discuss Dewey's (1944) progressive educational concept of the educational environment which today would metamorphose from "objects into words on a printed page, blackboard, or Internet; images on film, video, or a PowerPoint screen; materials in art class, equipment on the sports field; instruments in the music conservatory; or an apparatus in the science laboratory" that are manipulated to create meaning for both teachers and students. Hansen et al. (2008, p. 452) assert:

> In the same instant, teachers and students shift from being spectators or passive recipients of environmental effects. They become agents whose action with the curriculum generates educational experience that, however subtly at the moment or hard to measure, alters their knowledge, insight, sensibility, and dispositions.

Adding to the importance of creating a challenging educational environment, the National Council for the Social Studies (NCSS) defines the field of social studies as "the integrated study of the social sciences and humanities to promote civic competence" (NCSS website, 2010). NCSS standards (1994), used in the research intervention, are also used by teacher preparation programs.

While the significance of using broader disciplines, such as social studies, to build critical thinkers, theorists such as Freire (2004) suggests that the critical issue is "*what* he (the teacher) will dialogue with the latter (the student) *about"* (p. 128) and draws the line between content teaching as follows:

> For the anti-dialogical banking educator, the question of content simply concerns the organizing his own program. For the dialogical, problem-posing teacher-student, the program content of education is neither a gift nor an imposition—bits of information to be deposited in the students—but rather the organized, systematized,

> and developed 're-presentation' to individuals of the things about which they want to know more.

Gay, discussing the fact that multicultural education is not a separate part of teaching and learning, uses Banks and Banks (1992), and Nieto (2000), to be even more specific about the importance for multicultural student learning to promote human development, education, equality, academic excellence, and democratic citizenship. Gay (2004, p. 317) goes even further by explaining:

> students should not simply memorize facts about major events involving ethnic groups, such as civil rights movements, social justice efforts, and cultural accomplishments. Instead, educators should teach students how to think critically and analytically about these events, propose alternative solutions to social problems, and demonstrate understanding through such forms of communication as poetry, personal correspondence, debate, editorials, and photo essays.

Supporting legislation that improves opportunity for women, specifically science, technology, engineering, and mathematics (STEM) education for all students in H.R. 5116, AAUW (2004) endorsed the idea that quality education for all in STEM education will increase American's global competitiveness. The need for educational research into the difference in teaching methods and their outcome in student learning assessment is also underscored by Brock, head of the 2008 New Commission on the Skills of the American Workforce. At the Conference of the National Center of Education (2008), Brock stated that the problem with American schools is that "there is no quick fix" to the problem of low student achievement. He adds that the problem is complex but that:

> Perhaps most telling, (is that) no one really wants to admit that we are leaving millions of children behind. Education is the key to better jobs, higher incomes, and greater growth in what has become an extremely competitive global economy. Nothing is more important than education. Absolutely nothing…

The approach taken by this research does not take the form of another "quick fix" for education. Rather, the intent is to examine PBL to determine the relationship between that

teaching process and academic achievement demonstrated by traditional academic assessment, the standardized test, defined by Popham (2001, p. 39) as "any test that is administered and scored in a standard, predetermined manner." This definition of a standardized test is also reinforced by TerraNova, The Second Edition (2002, p. 8.2).

While I have clearly defined what my research is intended to examine, I feel it is also vital to state what is not intended by this research. Popham (2001) differentiates standardized tests such as the Iowa Tests of Basic Skills, Stanford Achievement Tests, and national or state standards-referenced or norm-referenced tests from tests constructed by teachers for their own classrooms. Many see standardized tests as repugnant or even counterproductive because of controversies excessive testing required by NCLB (2002). As a result of this controversy, a clear understanding of why I am choosing to use standards-referenced CTB tests for this research instead of classroom evaluations constructed by the teacher. Moreover, results or inferences made by this research are definitely *not* intended to advocate or even suggest the use of standardized tests for either evaluation of teachers, their classrooms, or any school. Popham (2001) agrees with a clear delineation between classroom and *standards-based* tests by pointing out that the role of standardized tests currently can be seen as being used to cause harm to our children because of NCLB (2002) but that a suitable use is to create "fine-grained and accurate comparisons among test-takers" (p. 42). However, this does "*not* include evaluating the instructional quality of (1) individual teachers or (2) the entire educational staff of a school" (Popham, 2001, p.39). While such assessments are needed, the structure or integrity is not in place yet. This is a comparison of PBL's and traditional teaching method relationships with standardized tests

and the teacher and groups involved in this research. Any further uses of the research will require further study.

CHAPTER II

LITERATURE REVIEW

The primary question addressed in this research is whether there is a difference in standardized test scores in students taught by traditional teaching methods and those taught using Problem-based Learning (PBL). In order to contextualize this research, the literature review will examine, in brief, four critical areas:

1. A background and summary of problem-based learning to fully define PBL's component parts;
2. How these components relate to the traditional classroom in an effort to define how traditional classroom teaching can be differentiated from problem-based learning;
3. A summary of teachers' beliefs and how these beliefs may impact problem-based learning; and
4. The history of what has been traditionally termed academic success/failure to underscore the importance of this research not only as empirical research but also as a political and social question.

Background Summary of PBL Component Parts

Problem-based Learning (PBL) is defined as an instructional method that uses real-life problem-solving skills in situations that simulate real problems to generate student learning. It is has also been called experiential learning when used to teach adults (Torbert, 2004; Mintzberg, 2004; Argyris, 2008; Jackson, 1994). It is primarily a cognitive theory approach to learning that builds on multi-faceted, interdisciplinary, and linked learning from other authentic, interdisciplinary, student-centered and cooperative learning settings

(Jonassen & Land, 2000). Other component parts typically included in PBL methodology include linking prior knowledge to new learning for greater understanding (Bruner, 1990).

The history of PBL includes components taken from constructivist theory, interdisciplinary teaching, multicultural methods, theories of multiple intelligences, use of real life problem skills, and student centered teaching methods. Interdisciplinary teaching, a key component of PBL, was developed largely from early constructivist theories. However, not all of these are grounded in the discipline of education. Examples of constructivist theories include Dewey's progressive education (1944) but can extend beyond traditional educational concerns and into discussions of cultural or community controversies and needs.

Constructivist ideas outside traditional educational perimeters can raise social, justice, and political questions that may be overlooked or minimized in the traditional classroom. Yet these social, justice and political questions can be a major focus for PBL as well a teacher education. For example, it can also lead to a variation of a present-day teachers' belief that the cultural backgrounds of low-income or minority children are impoverished or, more generally, that the limitations of firsthand experiences deprives the learner of the greater knowledge of other groups and other past histories. Buchmann and Schwille (1983. P. 40) reach just such a conclusion outlined in their essay on the pitfalls of relying too heavily on experience as the best teacher:

> Whatever one's origin, a restrictive reality born of first experience will not foster an enabling and transforming vision of action—although ideas can.

Thus, the question of whether learning by personal experience is better than other teaching methods may depend on the goals in the classroom (gatekeeping) and the teachers' beliefs, discussed extensively in this chapter. Additionally, a combined instructional approach, infusing a number of other ideas/knowledge from other cultures with methods that

encourage choices and creativity based on that knowledge, provide a better approach to learning. The intervention in this research purposely includes some traditional teaching approaches to learning at the beginning to enhance student understanding and familiarity with the format of the lesson and the process they will be undertaking in their PBL teams.

Benefits associated with PBL, according to advocates, include the intention to change the way teachers approach learning by their students as well as to create the environment for the development of higher-level thinking skills. It differs from traditional teaching methods, because it is a *process-based* approach that sometimes uses other curriculum-based learning methods. Such process-based approaches can include cooperative learning (Kagan, 1994), project-based learning, multiple intelligences theory (Gardner, 1993), and other popular teaching methods. Technology, using multimedia software, can also create opportunities for student-centered and multiple-intelligences learning approaches.

Following this line of reasoning, advocates of Gardner's (1993) multiple intelligences, English Language Learners, and other teacher education programs have used PBL effectively for low performing students. Berman (2006) researched student service learning in the U.S. and found it effective. Laitsch, Lewallen, and McCoskey (2005), along with multicultural theorists such as Gay (2000) and Freire (2005) emphasize the importance of programs for English Language Learners. Tertiary education using PBL has been researched by Cox (1999), examining the teacher-student relationship at the college level; and again by Rogoff (2001) to research group work using children and adults in a school community.

Research in science education has shown that this teaching method can engage students, improve test scores, and increase cooperative learning skills, increase a deeper understanding of the subject matter, increase self-direction and motivation and improve problem-solving abilities (Blumenfeld, Soloway, Krajcik, Guzdial, & Palinsax, 1991). While project-based and problem-based learning differ only slightly, the research points to overall results that are similar. More recent research reported by Cook (2009) supports this finding with the conclusion that teachers need a contextualized framework for teaching certain subjects in science, such as evolution. "Exploring the history of the theory, as well as its connections to modern day gives students not only social application but also the opportunity to understand the evidence and history that makes the theory unique" (p. 98). Cook's (2009) conclusions identify the same benefits for science learning acquisition that Bruner (1990) suggested earlier as needed to transfer (or connect) new knowledge into long term memory and/or knowledge that can be constructed. Moreover, being able to construct new knowledge from new and previous learning is a definition of higher-level thought.

Any discussion of higher-level thinking development would not be complete without linking the need for critical thinking with at least one major benefit to society. Thus, a quick discussion of the ability of history and social studies in the curriculum to create better and informed and participation in society, is included. This has a conflicted history. According to Westheimer and Kahne's (2004) summary of citizen educational priorities (using the Bradley Commission on History in the Schools, 1988; Vinson, 2001; Watras, 2004; and Wheland 2001), since 1988 there has been a wide variety of interpretations about what citizenship education really means. Supported by Hammond (2010), the current trend has been toward the idea that social studies includes a broad curricula emphasizing personal

responsibility for civic participation and social justice (Westheimer, King, Peckler, & Raney; 1992). Additionally, there are conflicting views on what citizenship actually means. Thus, the idea of what should be taught as social studies is complicated and complex. One conclusion that can be drawn is that PBL supports citizen participation and social justice but not all other interpretations. The value of civics-infused courses that include teaching methods, such as PBL, can support complex and higher-level thinking that is needed for such participation (Hammond, 2010). Another conclusion has been suggested by Shaver (1997, p. 214):

> In using Deweyan terms, to recognize and feel the problem—the incongruence between our intent and our achievements, the dissonance between our goals and our accomplishments—is the first step toward the reconstruction of our research…is needed.

Thus, Shaver suggests that disputes over the proper definition of social studies and effective research are related but that the argument over a single definition –i.e., either history-based or theory-practice—may be counterproductive—or even misguided. While there is a need for sound conceptual bases for what is taught as social studies in school, the acceptance and support of diverse ideas from the universities as well as those dictated by personal drives may be more productive. Shaver's views on the benefit of more than one definition of social studies raises research questions of whether encouragement of smaller, manageable units of knowledge, such as definitions or specific events, in an effort to increase all students' understanding of what is being taught while ignoring the global picture, may be limiting critical thinking in our classrooms. Thus, according to Shaver, differences in definitions may help promote critical thinking.

Adler and Goodman (1985), in examining student perspectives on social studies found that students believed that it was "a non-subject" (Abstract, p. 1); a means of teaching

human relations or citizenship; a school requirement; a connection or core for curriculum; and/or to provide the basis for social action. This study points to the fact that the official definition for the social studies has not filtered down to the students and may have been missed by some of its student teachers. For example, Kahne and Middaugh (2008) research suggests that high-quality social studies education in the U.S. is not uniform and the different practices may lead to unequal outcomes not only on such things as critical thinking but on democratic citizenship. Thus, beyond the question of a definition for social studies, is the concern over how social studies is being advanced in our schools. Many states no longer test social studies. The position established by the National Council for the Social Studies, approved by the Board of Directors (2007) reads:

> social studies educators recognized that fair and meaningful assessment of social multiple-choice and short answer examinations. Other social studies educators, however were disappointed to learn that social studies was not given a status equal to that of language arts and mathematics by the crafters of NCLB. They feared that the exclusion of social studies would lead to a diminution in the relative importance of social studies in American school systems. Events have proven both groups correct. Despite their initial differences, both groups of social studies educators are united by a common denominator, their belief that an education in social studies is essential to civic competence and the maintenance and enhancement of a free and democratic society. The National Council for the Social Studies believes that social studies is a core subject in American schools on an equal footing with reading, writing, mathematics and the sciences. It is the official position of the NCSS, therefore that the federal government should enact changes to the NCLB legislation to include core social studies disciplines. Both NCLB and existing assessment provisions of the National Assessment of Educational Progress (NAEP) should be rewritten so that student performance data may be disaggregated in such a manner thy all states can be compared to one another and to a national profile in the vital disciplines of history, civics, geography and economics.

The PBL intervention was designed with social studies as the interdisciplinary center for combining the different academics needed by students as they problem-solve. This approach was intended to conform to the NCSS position. As outlined, earlier, however, this

discussion only involved social studies and the use of PBL is not limited to any one subject, career, or population.

To demonstrate the comprehensive nature of PBL, a description of the major components of problem-based learning is needed. PBL includes but may not be limited to the following parts/components:

A. Interdisciplinary

Interdisciplinary learning links two or more disciplines together in the same lesson or unit. Interdisciplinary teaching methods, a key component of PBL, developed largely from early constructivist theories. The main idea defining constructivism began with the Socratic notion that there is a basic process for individual learning. Examples of constructivist theories, generally attributed to Piaget (1920), who espoused the idea of a constructive or progressive thought process that transforms existing knowledge into new knowledge or experience. The concept has a number of divergent theorists such as Vygotsky (1981), Bruner (1960), and include Dewey's progressive education (1944). Cognitive constructivism is based on the idea that people are constantly constructing new knowledge and do not readily acquire it from memorization or rote learning and that learning occurs more readily when the knowledge to be acquired has personal meaning or can be linked to knowledge already acquired. Constructivist learning can extend outside of traditional educational teaching and into cultural or community learning. Thus, it is likely to involve more than one academic discipline or be defined as interdisciplinary.

Darling-Hammond and McCloskey (2008), in examining academically high performing nations, notes that the integration of curriculum instruction (typically including more than one discipline) and that such assessment leads to the enhancement of both

teaching and learning. It is *how* the subjects are taught and assessed that makes a difference. Specifically, Darling-Hammond and McCloskey (2008, p. 264) call for a:

> focus on the so-called 21st century skills: the abilities to find and organize information to solve problems, frame and conduct investigations, analyze and synthesize data, apply learning to new situations, self-monitor and improve one's own learning and performance, communicate well in multiple forms, work in teams, and learn independently…most high-achieving countries rely largely on open-ended items that require students to analyze, apply knowledge and write extensively. Furthermore, these nations' growing emphasis on problem-based, inquiry-oriented learning has led to an increasing prominence for school-based tasks, which include research projects, science investigations, development of products, and reports and presentations about these efforts.

In summary, learning that involves active engagement with authentic problems, generally requiring knowledge of more than one discipline, has been shown to create a fertile environment for student learning.

B. Multicultural Methods

Multicultural theorists such as Gay (2000) and Freire (2005) define multicultural teaching as teaching that uses the home and community culture of students as prior knowledge to scaffold new learning. They also emphasize the importance of this methodology for English Language Learners. Research in science has shown that the teaching method can engage students, improve test scores, and increase cooperative learning skills, increase a deeper understanding of the subject matter, increase self-direction and motivation and improve problem solving abilities (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palinsax, 1991). Cook's (2009) conclusions identify the same benefits for science learning acquisition.

C. Cooperative Learning

Critical thinking is also a goal of Kagan's (1994) cooperative learning approach. The teaching method uses student collaborative groups to complete assignments. It is based

on Vygotsky's "zone of proximal development" (1981), defined as the recognition that a gap between what a student can do on their own and what they can do with guidance from others, may exist. PBL groups/teams are designed to fill this gap. Cooperative learning gives students an opportunity to discuss and to take responsibility for their own learning. According to Ennis (1996), cooperative learning encourages students to becoming critical thinkers.

D. Links to Prior Knowledge

Bruner (1960) outlines what he has observed as an essential component for learning. He challenged teachers to emphasize "big ideas". He suggested using several of these ideas in lesson planning, but using less of "everything of potential value" on each topic or discipline:

> For any subject taught in primary school, we might ask (is it) worth an adult's knowing, and whether having known it as a child makes a person a better adult. A negative or ambiguous answer means the material is cluttering up the curriculum (p. 52).

While Bruner (1960) can be seen as emphasizing the focus of the lesson on important concepts, he goes on to add that these big ideas:

> May be thought of as a linchpin, . . . which is essential for understanding. Without grasping the idea and using it to 'hold together related content knowledge, we are left with bits and pieces of inert facts that cannot take us anywhere.

On a broader note, we are born with not only the ability to learn but also a hunger for knowledge. Holt (1995), in his book, *How Children Learn*, describes the natural learning style of young children:

> The child is curious. He wants to make sense out of things, find out how things work, gain competence and control over himself and his environment, and do what he can see other people doing. He is open, perceptive, and problem-based. He does not merely observe the world around him. He does not shut himself off from the strange, complicated world around him, but tastes it, touches it, hefts it, bends it, breaks it. To

> find out how reality works, he works on it. He is bold. He is not afraid of making mistakes. And he is patient. He can tolerate an extraordinary amount of uncertainty, confusion, ignorance, and suspense. ...School is not a place that gives much time, or opportunity, or reward, for this kind of thinking and learning (p. 287).

When we learn, we need to be able to tie the learning to previously learned knowledge. When we link the new knowledge to the old, it becomes meaningful or important. Without meaning or importance, we do not learn and we cannot use the new learning for problem resolution. Ladson-Billings (1994) also reminds teachers that they need to begin with what a student already knows and understands. She calls this process "scaffolding" and suggests that it is a necessary building block for long-term memory and understanding for all of us. This factor, according to Ladson-Billings, is particularly important for disadvantaged, English Language Learners, and minority students.

PBL may hold a key component to student academic success by providing links needed to prior knowledge for some of America's underachieving student populations. For example, The American Association of University Women (1992) notes, "Few classrooms foster "connected learning." Flinders (2004, p. 213) adds "…nor are the majority of classrooms designed to encourage cooperative behaviors and collaborative efforts." Flinders (2004) research results strongly suggest that the typical classroom does not allow students to connect with previous knowledge, regardless of race, sex, or economic level. The study goes on to emphasize that while additional research is needed, teacher perspective may impact student achievement in general. Moreover, the Flinder's (2004, p. 213) study suggests that what teachers choose to leave out of the curriculum provides "limitations on the current curriculum." Recent research by The American Association of University Women continues to document a lack of women in science, technology, engineering, and mathematics (STEM disciplines) and concludes that, "The lack of women and girls in

STEM fields has significant implications not only for women's economic security, but for the overall economy as well" (AAUW Action Network <VoterEd @aauw.org>, 5/12/10) from St. Rose (2010). Thus, the learning environment created by a teacher's chosen teaching method and what they choose to include or exclude is vital to academic achievement. The Educational Trust (2001) research reinforces this conclusion and emphatically states that the environment created by the teacher has *the* major impact on student achievement.

Schussler (2009), in studying facilitation of intellectual engagement of previously disengaged students, suggests that moving beyond the disciplinary content and putting the focus on the individual student by knowing the student as an individual is a major factor for student engagement. She also found that when students feel that there is real opportunity for success, that there are choices for learning, and when students feel that the teacher has demonstrated that they are capable of learning; student excitement for content and opportunity to make learning relevant is increased. Active student engagement using authentic problems in the classroom also includes interdisciplinary learning, or teaching that links two or more disciplines together in the same lesson or unit. Lim (2008), in examining a number of situations using global citizenship as the theme, notes that "connections have to be built by readers as they relate to their experiences, of whether the account fits the situation in which they work and whether the approach is viable in their own system. In the process they acquire a new perspective for making sense of their experiences an customizing the suggestion to their own needs" (p.1089).

In summary, the inclusion of interdisciplinary realistic and authentic problems, multicultural emphasis that can lead to increased understanding, cooperative learning that helps create student responsibility for their own learning, and links to prior knowledge to

increase meaning and the ability to use the new knowledge are all essential components of PBL that have been shown to lead to active student engagement (Darling-Hammond & McCloskey, 2008; Schussler, 2009; Flinders, 2004; Ladson-Billings, 1994; Bruner, 1960; Gay, 2000; and Freire, 2005).

Differentiating PBL from Traditional Classroom Learning

Generally accepted teaching methods or "best practices" used in the traditional classroom cannot be excluded from quality classroom teaching or excluded from PBL. That is, PBL may contain components used extensively in traditional classrooms. Thus, the traditional classroom using PBL components would be expected to show similar results on the standardized tests when both the PBL classroom and the traditional classroom use identical educational teaching methods. For instance, these "best practices" in frequent use in the traditional classroom include Bloom's Taxonomy (1981) and Gardner's (1993) multiple intelligences approach to differentiated learning. Curriculum theory generally associates outcomes, such as increased relevance of knowledge to students and increased community involvement and awareness, with some of these practices. As a result, the differentiation between traditional teaching methods and PBL methods can be defined primarily more degree or intensity using PBL with the traditional classroom defined as more focused on the teacher, teacher-led discussion, teacher knowledge given to students, and competitive learning. The PBL classroom would then be observed to be focused on student discovery, discussion of more abstract and controversial ideas including some incorrect responses, student understanding and use of new knowledge, and collaborative learning.

Cultural and special needs included under the PBL umbrella use theories from Darling-Hammond (1992), Delpit (1997), Ladson-Billings (1994) and Ogbu (2002, 2003[a],

2003[b]). Other respected educational theorists such as Jacobs (2005), Jacobs (1989, 1997), Erickson (2001), Cuban (1993), Tyack (1974) along with Tyack and Cuban (1995) provide important measurement components when evaluating any unit of study. They support an interdisciplinary approach, essential for PBL, which goes beyond simply increasing academic test performance. This same point has been made and promoted, as mentioned previously, by cooperative learning (Kagan, 1994), design-based teaching (Wiggins & McTighe, 2005), and multicultural teaching (Gay, 2000; Banks & Banks, 1992). Thus, while interdisciplinary teaching may be observed frequently in the traditional classroom, identification of special groups by this research may prove helpful in analyzing any lack of differences in test scores between the research classrooms.

PBL is not limited to younger learners. In fact, its creation was designed to benefit adult education and has been used since the beginning of the twentieth century by the Harvard School of Medicine and has recently been used to train foreign students who plan to provide medical relief using U.S. foreign aid in their own countries when they complete their coursework (Harvard Medical School Website, 2010). Adult PBL applications often go beyond traditional academic knowledge and include studies that address such things as the implementation of organizational change. These include Torbert (2004) and Argyris (2008), examining leadership on organizational effectiveness, Mintzberg (2004), examining experiential learning in teaching graduate level business education, and Jackson (1994), looking at improvements in experiential learning. Long and successful uses of PBL in adult learning settings suggest that applications of PBL in K–12 academic settings may need to go beyond simplified lesson plans designed primarily to engage students for short periods of time and into more extensive research in classrooms.

Other benefits that tend to identify PBL from other teaching methods include qualitative studies that support the idea that individualized/differentiated learning, authentic learning, higher level thinking skills and even areas of reading and language enhancement are improved. For example, PBL enthusiasts link reading and language enhancement to De Saussure (1916), another constructivist theorist relevant to the history of PBL, who held the theory adopted by structural linguistics that meaning (or understanding) cannot exist outside of language. Saussure's concepts are credited for laying the foundation for much of what education calls structuralism, although the latter concept is quite diverse. While an understanding of Saussure is not essential to this research, he provided the foundation for research in linguistics and important progressive and psychological theories used by PBL (Dimitriadis and Kamberelis, 2006). They also add that scholars as diverse as Bernstein (1972), Piaget (1959), and even Freud (1922) built on the foundation established by Saussure. Later theorists, such as Bruner (1990) were instrumental in developing interdisciplinary learning, or teaching that links two or more disciplines together in the same lesson or unit.

As outlined earlier, supporters of PBL promote it as helping to create higher-level thinking (Jonassen & Land, 2000), because it includes both active learning and interdisciplinary methods through problem resolution. These theories, based on the earlier theories of Piaget (1995) and later, Gay (2000), depend heavily on the premise that long-term memory and learning is advanced when new learning is tied to what the student already knows and understands (Bruner, 1990). Jonassen and Land (2000) in promoting PBL, support Bruner's theory for individuals but also point out that specific groups and even entire learning populations also benefit. Jonassen et al. (2000) support the theory that

higher-level thinking skills develop by combining two or more learned ideas to develop a new idea based on increased understanding. Thus, learning easily extends beyond the individual.

Differentiating student learning or student-led, individualized learning enhancement from PBL classrooms has also been supported by educational theorists from qualitative studies but not linked to standardized test scores. Interdisciplinary teaching methods, cooperative learning (Kagan, 1994), design-based teaching (Wiggins & McTighe, 2005), and multicultural teaching (Gay, 2004; Banks, 1992) use key components of PBL. Additionally, theorists such as Gay (2004) have also suggested that certain interdisciplinary teaching methods such as PBL are the best way for certain groups of students, such as African Americans or females, to learn. Again, to re-emphasized, Jonassen and Land (2000), point out that with PBL not only specific individuals or groups benefit but the entire learning population is enhanced.

Conversely, other researchers, such as Margetson (1997), pointing to inconsistent findings both supporting and questioning results of PBL, indicate that the jury is still out. That is, PBL may or may not be more beneficial to student learning than traditional teaching. It may simply depend on the student, the classroom environment, and/or the teacher. Increased learning may even depend on whether the new lesson was successfully linked to previous learning by a particular student (Bruner, 1990).

Further, according to some doubters, even if PBL methodologies can be shown as better, there are still issues to be resolved before teacher/student acceptance can be assumed. Thus, they contend that the question of whether PBL can truly document increases in student achievement is still unclear. Additionally, according to some researchers, even a positive

research result, showing that increased achievement does result, the question of usability by teachers in the everyday classroom is still in question. Some teachers resist the teaching methodology in spite of its purported advantages and successes. Thus, this research is only the beginning. If a positive result is demonstrated between standardized tests and PBL, at least two questions remain for future study: (a) why does PBL increase these scores; and (b) why do teachers use or not use PBL?

Research theories on construction of meaning and authentic learning used to create PBL have been researched and tested extensively. They have been shown to be instrumental in providing a foundation for increasing academic performance, particularly for specific student populations. However, even when PBL is accepted as successful, two questions remain: (a) Is PBL successful because the process simply catches student attention; or (b) Can individualized meaning created by the student taught using PBL be transferred to long-term memory needed for standardized tests? These unanswered questions, however, have not deterred proponents from using it in the classroom or prevented universities, teaching institutions, or special training programs for teachers like the Kansas City Teaching Fellows (2001) from supporting it as a successful teaching method, particularly in the urban schools.

Teachers' Beliefs

Reviewing the research over the past thirty years relative to teachers' beliefs is intimidating for a researcher with strong beliefs about using uniform or academically agreed upon criteria for benchmarks or comparative purposes. Additionally, research on teachers' beliefs is challenging because of its comprehensive, conflicting nature, because little consensus exists for defining either what is actually being studied by teachers' beliefs or what has been learned (Pajares, 1992). Moreover, in spite of copious amount of research,

come critics indicate there is still data needed for essential aspects on teachers' beliefs. Critics include Clark and Peterson (1986) for a "conspicuous absence of attention" to secondary school teachers and researchers' tendency "to focus on relatively discrete and isolated aspects of teachers' thoughts and actions, rather than on the whole process of teaching…" (p.292). Shermis and Wasburn (1986) note that, "During the last ten years no article on the social characteristics, values or perspectives of social studies educators has appeared in the research journals of the profession…" (p. 331). Shermis attributes this to "teachers of the social studies who are uncomfortable with social science and its inquiry methods or who have rather limited understanding of the concepts, data and conclusions of social science" (p. 339). If so, he concludes, "it would explain, in part, the widely noted lack of change among social studies teachers" (p.339) and why research into social problems and critical thinking is limited in social studies. Shermis and Wasburn (1986) charge that the social studies is "predisposed not to perceive the problem, whether because of unfamiliarity with social science methods and content or because one is inextricably bound up in the social structure, it is unlikely that one's students or the students of one's students will be able to do" (p. 339).

This review of literature cannot be defined as a comprehensive review of teachers' beliefs because of the vast research available on the subject, the comprehensive and diverse nature of teachers' beliefs, the differences in desire to study, and/or generally acknowledged lack of clarity in defining teachers' beliefs for research (Pajares, 1992; Clark & Peterson, 1986; Shermis & Wasburn, 1986; and others). Instead it will address selected, well-respected researchers' findings and how this research relates to principles of practice, why teachers' beliefs are important, how teachers create their beliefs, the difficulty of unlearning

old ideas and resistance to change, beliefs about specific topics such as management and how those beliefs might impact teaching.

Because of the enormous importance and impact of teachers' beliefs on education, the subject will be addressed again in the section outlining future research. While this research is narrowly focused on problem-based learning and its relationship to standardized tests, it is obvious from the data collected and the conclusions that any teaching method, most certainly PBL, will be heavily influenced by teachers' beliefs. Valid and reliable research demands further development of research on teachers' beliefs to be effective. Much of the decision on whether to use research on this topic focused literature on teachers' beliefs typical or general teachers' beliefs and factors that may create barriers or opportunities for PBL to be successful. Detailed research on teachers' beliefs directly influencing this research will be matched to the overall conclusions in Chapters 4, 5, and 6. This approach will, hopefully, narrow the focus of the inquiry while still clarifying the relationship between teacher's beliefs, student learning responses, and PBL impact.

Over thirty (30) years ago, Fenstermacher (1979) suggested that the study of teachers' beliefs would lead research on teachers' effectiveness but his prediction did not materialize because of the ambiguity referenced earlier, particularly in divergent definitions for what teachers' beliefs actually are. Goodman (1988) defines teachers' beliefs simply as thoughts, feelings perceptions, values, and actions that teachers feel are effective in the classroom. Goodman's study was guided by "principles of ethnographic semantics" meaning the participants defined their own beliefs using their own definitions. Nespor (1987) confirms the ambiguity of research on teachers' beliefs by recording, "little attention has been accorded to the structure and function of teachers' beliefs about their roles, their

students, the subject matter areas they teach, and the schools they work in" (p. 317). While Nespor (1987) differentiates teachers' beliefs and knowledge systems, he also indicates that there is no requirement for group consensus or logical consistency for validity and suggests that belief systems "rely much more heavily on affective and evaluative components than knowledge systems" because these "personal preferences seem to operate more or less independently of other forms of cognition typically associated with knowledge systems" (p. 319). Kagan (1990) disagrees with Nespor and defines teachers' beliefs and teachers' knowledge as research on the same concept. Nespor (1987, p. 321) goes on to add that teachers' beliefs are based on life experiences, and their development cannot be predicted:

> Belief systems can be described as loosely-bounded systems with high variable and uncertain linkages to events, situations, and knowledge systems. In other words, there are no clear logical rules for determining the relevance of beliefs to real-world events and situations.

Other researchers, such as Clark and Peterson (1986) define beliefs generally as teachers' thought processes (beliefs) that result in principles of practice that teachers use to explain their teaching behavior. Only three to six are needed and they include such concepts as "student characteristics and states, teacher states, and, to a lesser extent; with the structure and organization of subject matter" (p. 291). Clark and Peterson (1986) describe these illusive thought processes as the "most significant and far-reaching" because "beliefs that teachers have about students are those that deal with teachers' perceptions of the causes of students' behavior, in other words teachers' attributions for the causes of students' performance" (p. 281). These causal belief explanations (attributions) by the teacher regarding student behavior may influence student performance (Darley & Fazio, 1980; and Peterson & Barger, 1984) and can lead to enhancing or deflating teacher's beliefs regarding their success or failure in the classroom (Clark & Peterson, 1986, p. 282).

Pajares (1992) agrees with Nespor (1987) that belief research is obviously inconsistent in meaning and does not attempt to provide agreed-upon definitions for teacher knowledge and teacher beliefs. While recognizing Nespor's distinction between beliefs and knowledge as reasonable, Parjares (1992) also notes that the question of which of the two is most important to education is also missing. While not diminishing the importance of teachers' beliefs to educational research, Pajares (1992) also recommends that the nature of beliefs be expanded and explored more fully because of the diverse socialization process and because of beliefs tendency to "endure, unaltered unless they are deliberately challenged" (p. 316; paraphrasing Lasley, 1980). Agreeing with Pajares (1992), Nespor (1987) explains: "We need a theoretically-grounded model of 'belief systems' that can serve as a framework for systematic and comparative investigations" (p. 317). Based on extensive review of previous research (Abelson, 1979; Sigel, 1985, Harvey, 1986, Nisbett & Ross, 1980, Dewey, 1933; Rokeach, 1968; Tabachnick & Zeichner, 1984; Janesick, 1977; Clark & Peterson, 1986; Green, 1975; and Goodman, 1988); Parjares (1992) provides a general definition for educational research that clearly differentiates knowledge and belief: "Belief is based on evaluation and judgment; knowledge is based on objective fact" (p. 313). In an attempt to make teachers' beliefs more palatable to the abstract-squeamish traditional researcher, Pajares (1992, p. 324-326) summarizes the assumptions from his own review of the research and identifies the following research findings as "reasonable":

> What is one to make of belief, then? Sifting clarity from the complexity of any psychological construct is seldom easy, but researchers have expressed confidence in a number of findings, and some inferences and generalizations can be made with reasonable confidence. They are offered below not as a compendium of categorical truths but as fundamental assumptions that may reasonably be made when initiating a study of teachers' educational beliefs.

1. Beliefs are formed early and tend to self-perpetuate, persevering even against contradictions caused by reason, time, schooling, or experience (Abelson, 1979; Buchmann, 1984, 1987; Buchmann & Schwille, 1983; Clark, 1988; Florio-Ruane & Lensmire, 1990; Ginsburg & Newman, 1985; Lasley, 1980; Lortie, 1975; Munby, 1982; Nespor, 1987; Nisbett & Ross, 1980; Posner et al., 1982; Rokeach, 1968; Schommer, 1990; Van Fleet, 1979; Wilson, 1990).

2. Individuals develop a belief system that houses all the beliefs acquired through the process of cultural transmission (Abelson, 1979; Brown & Cooney, 1982; Eisenhart et al., 1988; Nisbett & Ross, 1980; Peterman, 1991; Posner et al., 1982; Rokeach, 1968; Van Fleet, 1979).

3. The belief system has an adaptive function in helping individuals define and understand the world and themselves (Abelson, 1979; Lewis, 1990; Nisbett & Ross, 1980; Rokeach, 1968; Schutz, 1970).

4. Knowledge and beliefs are inextricably intertwined, but the potent affective, evaluative, and episodic nature of beliefs makes them a filter through which new phenomena are interpreted (Abelson, 1979; Calderhead & Robson, 1991; Eraut, 1985; Goodman, 1988; Nespor, 1987; Nisbett & Ross, 1980; Posner et al., 1982; Schommer, 1990).

5. Thought processes may well be precursors to and creators of belief, but the filtering effect of belief structures ultimately screens, redefines, distorts, or reshapes subsequent thinking and information processing (Abelson, 1979; Calderhead & Robson, 1991; Goodman, 1988; Nespor, 1987; Nisbett & Ross, 1980; Posner et al., 1982; Rokeach, 1968; Schommer, 1990).

6. Epistemological beliefs play a key role in knowledge interpretation and cognitive monitoring (Anderson, 1985; Kitchener, 1986; Nespor, 1987; Nisbett & Ross, 1980; Peterman, 1991; Posner et al., 1982; Schommer, 1990).

7. Beliefs are prioritized according to their connections or relationship to other beliefs or other cognitive and affective structures. Apparent inconsistencies may be explained by exploring the functional connections and centrality of the beliefs (Kitchener, 1986; Nespor, 1987; Peterman, 1991; Posner et al., 1982; Rokeach, 1968; Schutz, 1970).

8. Belief substructures, such as educational beliefs, must be understood in terms of their connections not only to each other but also to other, perhaps more central, beliefs in the system (Kitchener, 1986; Peterman, 1991; Posner et al., 1982; Rokeach, 1968). Psychologists usually refer to these substructures as attitudes and values.

9. By their very nature and origin, some beliefs are more incontrovertible than others (Abelson, 1979; Bandura, 1986; Clark, 1988; Lewis, 1990; Lortie, 1975; Nisbett & Ross, 1980; Rokeach, 1968).

10. The earlier a belief is incorporated into the belief structure, the more difficult it is to alter. Newly acquired beliefs are most vulnerable to change (Abelson, 1979; Clark, 1988; Lewis, 1990; Munby, 1982; Nespor, 1987; Nisbett & Ross, 1980; Posner et al., 1982; Rokeach, 1968).

11. Belief change during adulthood is a relatively rare phenomenon, the most common cause being a conversion from one authority to another or a gestalt shift. Individuals tend to hold on to beliefs based on incorrect or incomplete knowledge, even after scientifically correct explanations are presented to them (Abelson, 1979; Lewis, 1990; Nespor, 1987; Nisbett & Ross, 1980; Posner et al., 1982; Rokeach, 1968).

12. Beliefs are instrumental in defining tasks and selecting the cognitive tools with which to interpret, plan, and make decisions regarding such tasks; hence, they play a critical role in defining behavior and organizing knowledge and information (Abelson, 1979; Bandura, 1986; Lewis, 1990; Nespor, 1987; Nisbett & Ross, 1980; Posner et al., 1982; Rokeach, 1968; Schommer, 1990).

13. Beliefs strongly influence perception, but they can be an unreliable guide to the nature of reality (Abelson, 1979; Bandura, 1986; Buchmann & Schwille, 1983; Lewis, 1990; Nespor, 1987; Nisbett & Ross, 1980; Rokeach, 1968).

14. Individuals' beliefs strongly affect their behavior (Abelson, 1979; Bandura, 1986; Brown & Cooney, 1982; Clark & Peterson, 1986; Eisenhart et al., 1988; Ernest, 1989; Goodman, 1988; Harvey, 1986; Kitchener, 1986; Lewis, 1990; Nespor, 1987; Nisbett & Ross, 1980; Rokeach, 1968; Tabachnick & Zeichner, 1984).

15. Beliefs must be inferred, and this inference must take into account the congruence among individuals' belief statements, the intentionality to behave in a predisposed manner, and the behavior related to the belief in question (Goodman, 1988; Janesick, 1977; Rokeach, 1968; Tabachnick & Zeichner, 1984).

16. Beliefs about teaching are well established by the time a student gets to college (Abelson, 1979; Buchmann, 1984, 1987; Buchmann & Schwille, 1983; Clark, 1988; Clark & Peterson, 1986; Cole, 1989; Floden, 1985; Florio-Ruane & Lensmire, 1990; Ginsburg & Newman, 1985; Lortie, 1975; Nespor, 1987; Nisbett & Ross, 1980; Rokeach, 1968; Weinstein, 1988, 1989; Wilson, 1990).

Additional research has been accepted since Pajares's (1992) summary. These include Fang (1996) suggestion that future research on teachers beliefs needs to direct

attention to the following five areas: (a) move from providing teachers with theory and into providing them with understanding and coping skills for the complex, diverse classroom and how to implement the theories realistically; (b) provide more research for secondary and post-secondary levels; (c) attention to the underlying knowledge students need to individualize learning (such as vocabulary for reading); (d) aligning teachers' beliefs with successful learning and teaching; and (e) expand the scope of research from single areas, such as reading, into content areas such as math, science, biology, chemistry or physics. As noted earlier, problem-based learning (PBL) incorporates and intertwines application of the material throughout content areas. Dweck (1986), a psychologist not included by Pajares (1992) adds data on how teachers' beliefs motivate students is also needed.

If research on teachers' beliefs is so badly flawed that much of the excitement of the past thirty years has disappeared, why study beliefs when there is so much in education that needs to be examined? The answer is simple. While it might be convenient and easy to simply eliminate belief research because it is not fully grounded in proper, adopted, and consensus-oriented; it is not realistic. Respected researchers outside of education, such as Dweck (1986) recognize that strict adherence to traditional and old-school scientific methods may not provide realistic or doable answers to social problems. Dweck, a psychologist, in examining student motivation notes:

> the focus is on psychological factor other than ability, that determine how effectively the individual acquires and uses skills…It has long been known that factors other than ability influence whether children seek or avoid challenges, whether they persist or withdraw in the face of difficulty, and whether they use and develop their skills effectively (p. 1040).

According to the Education Trust (2003) the most important feature in the classroom is the teacher. They were not referring to teachers' knowledge so much as the teachers'

ability to inspire (or motivate) learning for all students regardless of poverty, social class, family background, or culture. This signals recognition of the need to move beyond one method of teaching in the classroom. It also suggests that a teacher's knowledge may not be the highest skill required for today's diverse learning environments. This movement away from the teacher as the expert is also supported by Carter and Doyle (1996) as a movement from teachers' belief research designed to verify an appropriate knowledge base for teachers to an emphasis on empowerment of teachers because of their ability to effectively use their classroom experience for student learning. In other words, using the life experience and history (belief system) of effective teachers, their voice and experience as a vital "educative medium" (p.120). Interestingly, Ross (1995) indicates that teachers' belief about their own success results in teachers who "set more challenging goals for themselves and their students, accept responsibility for the outcomes of instruction, and persist through obstacles" (p. 227). Hargreaves (1996) also emphasizes the importance of teachers' beliefs by suggesting that teachers insist that educational reforms begin with them and that they include teachers' "common sense insight" (p. 12).

Other research not includes by Pajares (1992) includes Thornton (1991) using research sponsored by the National Science Foundation in the 1970s, Shaver, Davis, and Helburn (1980) asserts that teachers' beliefs about the nature of education, school, knowledge of the subject, use of materials and resources, and how these are actually taught in the classroom; evolve from an individual reflective process and personal decisions that result in the daily experience of students. Thornton characterizes these day-to-day decisions as "curricular-instructional gatekeepers" (p. 237). Further, teachers tend this "gate" based on what Beard (1934, p. 182) called a "frame of reference":

> since all things known cannot be placed before children in the school room, there must and will be, inevitably, a selection, and the selection will be made with reference to some frame of knowledge and values, more or less consciously established in the mind of the selector.

Thornton (1991) notes that the term "frame of reference" has many other terms used by numerous other researchers with similar meanings. However, Thornton (1990) adds the gatekeeping, day-to-day classroom decision-making by the teacher, has three readily identifying parts: "(1) beliefs concerning the meaning of social studies, (2) decisions concerning planning, and (3) decisions concerning instructional strategy" (p. 238). Prawat (1992) underscores the importance of instructor-accepted ideas about teaching and learning that have been adopted by an individual teacher:

> Teachers are viewed as important agents of change in the reform effort currently under way in education and thus are expected to play a key role in changing schools and classrooms. Paradoxically, however, teachers are also viewed as major obstacles to change because of their adherence to outmoded forms of instruction that emphasize factual and procedural knowledge at the expense of deeper levels of understanding (Abstract, p. 1).

Teachers' beliefs along with ideas, preferences, or attitudes about his/her teaching or students and may also include a number of opinions on diverse elements including methodologies that work or do not work in the classroom. These beliefs also include such things as general student expectations and opinions regarding proper discipline, and may even include ideas regarding proper school administration (Tyler & Boelter, 2008). Allport (1967) includes attitudes, values, and predispositions while Goodenough (1963) adds views of the world including understandings that are felt to be true. This contrasts with Pajares (1992) who defines concepts such as attitudes values, preconceptions, theories and images as "beliefs in disguise" (Richardson, 1996). Richardson (1996), in adopting a definition similar to Green (1971), defines beliefs as: "a proposition that is accepted as true…different

from knowledge…implying epistemic warrant" (p.104) and also points out that similar terms are used in teacher education literature.

Teacher's beliefs about (a) what is effective teaching, (b) how students learn, and (c) who and what can be taught are used by a teacher to assess whether or not learning is taking place. A particular teacher's beliefs and expectations have been shown to be consistent predictors of performance outcomes, including capability and even engagement, for elementary, middle, and secondary students (Tyler and Boelter, 2008). Thus, quality teachers have a belief system that allows them to accurately predict learning while less effective teachers may have a belief system that is less effective.

Teacher beliefs are important links to student academic success. For example, African Americans' low-level academic performance has been linked to perceptions of low teacher expectations and the teacher-student relationship (Ferguson, 2003; Norguera, 2003). Moreover, Richardson (2003) suggests that teachers' beliefs are/should be a developmental responsibility of effective teaching. That is, not only does the teacher develop professionally by reflectively deciding "*what* to believe but also *how* to believe it" (Richardson, 2003, p. 4). Thus, one of the major important attributes of teachers' beliefs is that they lead immediately and directly to what students learn and influences student beliefs.

While the importance of teachers' beliefs cannot be minimized for a researcher examining education today, other important aspects are still missing. For example, Pajares (1992, p. 307) emphasizes:

> Although research on teacher thinking is abundant and thriving (see Clark & Peterson's review, 1986), critics have questioned how its findings can be of use to teachers or teacher education. They suggest that another perspective is required from which to better understand teacher behaviors, a perspective focusing on the things and ways that teachers believe (e.g., Clark, 1988; Cole, 1989; Fenstermacher, 1979, 1986, Nespor, 1987, Pintrich, 1990). This view is based on the assumption that

> beliefs are the best indicators of the decisions individuals make throughout their lives (Bandura, 1986; Dewey, 1933; Nisbett & Ross, 1980; Rokeach, 1968), an assumption that can be traced to human beings' earliest philosophical contemplations.

Agreeing with Pajares (1992), Kagan (1992) calls teachers' beliefs a "piebald form of personal knowledge" but asserts that it "lies at the very heart of teaching" (p. 85). For Kagan (1992), the importance of these beliefs "may be the most obvious assessment of a teacher's growth and helps to explain how good teachers develop" (p. 85). Such information is vital for teacher education and in-service development programs. Thornton (1992) supports Kagan and cautions policymakers against discounting the teachers' personal views. Thornton, concerned with teaching, in general, and social studies teachers, specifically, calls for greater understanding of teachers' beliefs. It creates conflict and tension identified by Fenstermacher (1994) resulting from "researchers' claims to know some things about teaching, as well as their claims that teachers (also) know some things about teaching" (p. 4). Fenstermacher (1994, p.50) emphasizes the importance of both belief claims because both views become educational policy even when they do not fit any scientific model:

> it suggests that the critical objective of teacher knowledge research is *not* for researchers to know what teacher know but for teachers to know what they know. It is, as I believe Cochran-Smith and Lytle would agree, for teachers to be knowers of the known. Both conventional social science and the alternatives can assist in attaining this objective. If, however, the science we use seeks simply to know what known by others, it is neither a very powerful nor a very useful science.

Since teachers' beliefs are seen by researchers as ambiguous, sometimes illusive, and certainly complex, understanding may be gained by examining some of the research exploring the creation of teachers' beliefs. While beliefs, particularly in the reflective teacher, may change over time, most teachers enter the profession because they have a

desire to teach. For many teachers it may evolve from a desire or enjoyment that developed into self-knowledge and then into a belief that they should be a teacher. Murphy, Delli, and Edwards (2004, p. 89) indicate that beliefs for both teachers and students may being as early as the second grade:

> For practitioners, its seems imperative that primary grade teachers (and teachers at all levels) understand how powerfully beliefs about teaching are being shaped in influencing students' understandings of the teaching profession…In essence, we must be mindful that the apprenticeship of observation that is taking place in schools begins early and that those insider beliefs will influence future generations of educators.

In researching pre-service teachers, Moyer and Husman (2006) found four reasons why teachers decided to become teachers: "(1) family; (2) past teachers; (3) peers; and (4) teaching experiences" (p. 38). Because of successful experiences with past teachers, peers, and early teaching experiences, a basic and observable understanding of teacher's beliefs is that teachers teach the same way they were taught and how teaching is modeled for them (Hanegan, Friden, Nelson, 2009). In this study, examining differences in two types of professional development programs, one using authentic inquiry and the other using simulated inquiry; the matched controlled study found that teachers modeled the professionals they had observed.

The recognition that teachers tend to teach the way they were taught is further supported research by the Department of Educational Psychology & Learning Systems at Florida State University (Roehrig, Turner, Grove, Schneider, & Liu, 2009). Research comparing six starting teachers to a respected/experienced teacher and coded the teachers on teacher beliefs, classroom practices, and student engagement found that the most effective teachers demonstrated observable positive practices, beliefs and students' engagement while the less effective teachers had less student engagement, practices undermining practices and

beliefs. They also noted that poorer teachers that recognized their counterproductive beliefs could change and become effective teachers. Logically, the idea that teachers teach the way they were taught and how teaching was modeled for them is directly related to discipline-specific teacher-knowledge. This discipline-specific academic environment may emphasize individualized skills specific to one discipline (or perception of subject matter) that influences not only "how" they teach but also "what" they teach or emphasize. Obviously, such differences will also change teacher's beliefs and expected outcomes from students. Monte-Sano and Cochran (2009) found that two graduate history professors, one emphasizing historical understanding, and the other emphasizing reading comprehension and student engagement; demonstrated "understanding of the knowledge base of teaching in spite of their differing approaches to history" (p. 101).

Levin and He (2008), in researching the personal practical theories (PPTs) of perservice teachers found that what the teachers actually used to develop the classroom environment and beliefs about teachers came from their family background and personal K-12 experience while the teachers' belief about instruction and the nature of students came from their teacher education experience. Levin and He (2008) also caution that knowledge from the "teacher education years is a 'weak' intervention" (p.67) because of teachers' strongly held beliefs. His findings are supported by Lortie, 1975; Kagan, 1992; Richardson, 1996, 2003; along with Zeichner and Liston, 1987. Later research by Richardson (2003) found three sources for beliefs and attitudes: "personal experience, experience with school and instruction, and experience with formal knowledge—both school subjects and pedagogical knowledge" (p. 5). Richardson, in differing with Levin and He (2008), found

that schooling and instruction experience was more influential on pre-service teachers. Johnston (1990, p. 230) disagrees with both and suggests:

> Learning to teach may not be a matter of one influence overpowering all others; it may be more a matter of interactions and continuities…any influence, whether program, school or persons, will be partial and differential. There are multiple influences that interact in any teacher education program; beliefs will be reconstructed in individual ways by persons with different histories and personalities. Students' background and personalities provide a complex of beliefs and assumptions that will interact with new influences in unpredictable ways.

Johnston (1990) concludes that lack of predictability is good because it opens the door of expanding learning opportunities for education programs and against teacher educators' reliance on simple expectations or conclusions. Students will interpret their education courses based on what they bring to our education programs. Combined with Adler's (1984) admonition that understanding the insights and interpretations of teachers is vital to successful teaching, Johnston (1990) concludes, "we can learn from our students and they from us" (p. 230). Richardson (1991) suggests that insight and interpretation increase should come from three sources "teachers' background theories beliefs and understandings of the teaching and reading process; theoretical frameworks and empirical premises as derived from current research; and alternative practices that instantiate both teachers' beliefs and research knowledge" (p. 579).

How easy/difficult is it for teachers to unlearn old ideas and belief systems? Walker (2009), suggesting that simple and basic knowledge can lead to change, indicates that changes in classroom environment can be accomplished using parenting style theories of control and nurturance to achieve and maintain classroom control and the type of classroom where quiet and independent study is the teacher's goal. McWilliam (2008), indicating that a more planned and stringent approach may be needed, points out that teachers may need to

unlearn old ideas that have been helpful in the past but that are now less effective. McWilliam (2008, p. 265) suggests that teachers spend:

1. Less time giving instructions and more time spent being a usefully ignorant coworker in the thick of the action;
2. Less time spent being custodial risk minimizer and more time spent being an experimenter and risk-taker;
3. Less time spent being a forensic classroom auditor and more time spent being a designer, editor and assembler;
4. Less time spent being a counselor and "best buddy" and more time spent being a collaborative critic and authentic evaluator.

Resistance to change has been outlined earlier with much of it attributed to the enmeshed nature of teachers' belief and positive reinforcement from family, peers, past teachers, and their own teaching experience (Murphy, Delli & Edwards, 2004; Richardson, 2001; and Moyer & Husman, 2006). Supporting this less than positive prognosis for change, Ravindran, Greene, and DeBacker (2005) examined the relationship of achievement goals, beliefs, cognitive engagement, and application of learning of pre-service teachers. Ravindran et al. (2005) found, using regression analysis, that the only statistically significant predictor of learning was a small, or shallow, relationship with cognitive engagement—and this was a negative relationship. In other words, there was very little difference in pre-service teachers' teaching practice and what was learned was minimal. Ravindran et al. (2005) also recommend that teaching institutions "challenge pre-service teachers' naïve epistemological beliefs" (p. 230) with a push toward more reflective thought in their educational programs. They point out that teachers who are unable to think critically themselves are unlikely to inspire critical thinking in their students. Specifically, Ravindranet al. (2005) suggest establishing a requirement for "epistemological sophistication" to teacher education that may achieve greater levels of critical thinking by

deliberately confronting the belief that attaining knowledge is "simple and certain" (p. 230) or can be taught simplistically and/or reduced to its most elementary and basic form.

Onosko (1989) examined beliefs and theories of teachers who were considered outstanding at promoting higher-level thinking with those that did not and noted that the latter tended to emphasize content acquisition where the former viewed content as a tool for promoting reflection and new ideas. Moreover, Onosko (1989) quotes from one of his higher-level thinking teachers that it is an effective pedagogy to hold what the teacher knows "in restraint" (p. 191). He concludes by suggesting that this goal to teach higher-level thinking holds the key that causes a knowledgeable teacher to restrain the "impulse toward exposition and coverage" (p. 191) while those that do not believe higher-level thinking can be taught or who see it as beyond their student's grasp, might tend to view knowledge from the teacher to the student as more reasonable and doable.

Munby, Russell, and Martin (2001) are even less optimistic about the potential for overcoming resistance to changing beliefs. They refer to research by Richardson's (1996), conclusion suggesting that pre-service teachers beliefs may be so strong that teacher education has no effect. This is based on Green's (1971) definition that belief "describes a proposition that is accepted as true by the individual holding the belief" (p. 104). Munby, et al. (2001) point to additional support for this conclusion from research by Block and Hazelip (1995), and included Kagan (1992), that find that established and enmeshed beliefs are not likely to change.

Angell (1998), on the other hand indicates that change is possible when presented to teachers in professional development for reflection and discussion. However, she notes, "Belief restructuring appeared to be influenced by program elements that overlapped, giving

force to new ideas, and by the extent to which the individual was willing to consider change" (p. 527). Overlap, according to Angell (1998) required follow up and observation by supervisors, collaborative efforts, and involvement with other teachers who had had similar or the same development courses. Even when these overlapping efforts were established, change involved such variables as being vulnerable to others' perceptions and feedback for clear understandings. Thus, it is evident that successful change involved the support of other professionals. Thus, it can be reasonably concluded that socialization is an element of successful belief change.

Gupta and Saravanan (1995) examined teachers' resistance to change in reading instruction based on how trainees thought about the new instruction methods when compared to their earlier belief systems and found that some beliefs remained unchanged. This was particularly evident when an older method leading to the belief had been used successfully in their personal school experience. Gupta and Saravanan (1995) concluded:

> For training to be effective, we need to take account of trainees' prior convictions and demonstrate how conventional techniques do not work. If this is not done, trainees will exit with schemata that they cannot reconcile and will eventually revert to traditional methods with which they and the school are comfortable. What we need to do is bring about a cognitive change and a dissatisfaction with the methods they were used to seeing in action during their schooldays (p. 359).

So, how important is the district and school culture in the success of changing beliefs? Evans (1990) described five history teachers using "five typologies" for classroom learning and focuses on student understanding of the curriculum and student beliefs about their learning. Evans (1990) found that the differing teaching approaches had little impact on student belief in four of the classrooms and a profound impact in one. What was interesting, however, was the implicit link the students identified to the competing

ideological orientations. In other words, teachers of the same subject can teach using differing and competing ideological orientation or beliefs and still be successful.

How important are the academic experts in defining what is successful? What impact on change can be attributed from the school culture, or perceived institutional expectations? Ross (1987) researched teachers' perspectives and the role that institutional constraints played in change. He found that socialization for pre-service teachers is a complex process with the ability to create and maintain conditions favorable to individual teaching perspectives and actions. However, when teachers are confronted with institutional constraints, these changes may not last. In fact, the most important belief developments occur in prior experiences and the individual teachers background and biography. Thornton (1991), in examining the role of the curriculum gatekeeping function, suggests that gatekeeping beliefs can be linked to those established by association with successful teachers in the past, now considered experts by teacher belief, and established internally as what is considered to be professional behavior. Thornton (1991, p. 245) notes:

> others do not appear to be aware of, and may not be particularly interested in, the degree of control that their gatekeeping exercises over the curriculum they plan for their students. Rather, practicality and socialization to prevailing school norms are central features of what teachers consider when they plan.

Classroom management has been promoted by numerous educators as a benchmark to identify a good teacher. Wong and Wong (1998, p. vii) indicate, "The effective teacher is an extremely good classroom manager." For example, one teacher's belief about good classroom management might be defined as one where the classroom is quiet and where students can concentrate on assignments independently.

Walker (2009) discusses classroom environment from research on parenting style theory to achieve classroom control and the type of classroom where quiet and independent

study is the teacher's goal. Walker (2009) examined control and nurturance, defining two parenting styles, and compared their classroom environmental influence on student learning. She also examined how control and nurturance interact on student engagement and learning in the classroom and concludes by asking critical questions about these teacher beliefs:

> Can you establish effective (classroom) control without also demonstrating nurturance? Do positive teacher-student relationships always result in better learning outcomes? (p. 128).

Genuine concern for students (Banks & Banks, 1992; Delpit, 1997; Freirie, 2005; Gay, 2000; Ogbu, 2003; etc.) has been shown to be a necessary ingredient for the classroom. Noddings (2001) notes that caring can be defined as "an attitude, but it can also be used to describe a relation or to point to something far deeper and more important—a way of being in the world" (p. 99). Noddings (2001, p. 101) explains that a conflict exists between caring and professional life, particularly in education, and that the demonstration of a caring attitude can be seen as unprofessional:

> Conflicts between caring and professionalization have occurred at every level in education. In school administration, for example, the conflict dates to the early part of this century. Sometimes the conflict took the form of an attack on democratic procedures; arguments were launched against the participation of laypersons in school affairs, and it was suggested that all decision be made at appropriate professional levels. The stories of Ella Flagg Young, Susan Dorsey, and Julia Richman (Blount, 1996) show graphically how several women in powerful positions (superintendents in Chicago, Los Angeles, and New York respectively) consistently used method congruent with a caring orientation even though equally powerful men were speaking publicly against their mode of administration. The debate continues today (Beck, 1994).

The importance of this conflict between caring and professionalism can extend to more generalized areas of conflict between teachers/ beliefs and what other teachers, district officials, and parents may define as effective teaching. Nodding (2001, p. 101) explains:

> For caring teachers today, the demand to teach everyone the same material may pose a great dilemma. Teachers agree that all children must acquire certain skills but

> many fine teachers believe not only that children gain skills at very different rates, but also that children should be allowed to pursue different interests beyond these skills. Both Dewey and Rousseu support teachers in this belief.

Gersten, Walker and Darch (1988) along with Walker and Rankin (1983) describe the increasing student diversity in public school classrooms and researched the potential problem of mainstreaming these students in classrooms of teachers with strong beliefs about student work habits and classroom behavior. Gersten et al. (1988) and Walker et al. (1983), supported by Fuchs, Fuchs, and Phillips (1994) found strong resistance for including these students in their classrooms. Jenkins, Jewell, Leceister, Jenkins and Troutner (1990) and Pallas, Natriello and McDill (1989, p. 343) suggest that this increased diversity may create an environment where the best and most effective teachers are the "least willing to work with the most problematic students." Gersten et al. (1988, p. 437) points out that removing these students from the classroom might logically "guard against inefficient use of academic instructional time, which could result in an overall decreased level of student performance."

In a study on teachers' perceptions of at-risk students, Koehler (1988, Abstract) used a survey to determine teachers' attitudes and found that teachers:

> failed to see their own role in the creation of an environment and set of expectations that affected both the labeling of at-risk students and the students' behavior and that they themselves may limit the students' potential for academic achievement. The teachers' limited awareness of the problems of the social constructivist nature of their labeling can result in programs that deal with students' individual problems but fail to implement structural changes in classrooms and schools.

Thus, it can be inferred that conflict between what is perceived as professional by the academic community and the recognition by the academic community that beliefs are loosely defined, highly individualized, and, while essential to provide data for classroom effectiveness, beliefs do not (as yet) provide the definitional consensus for concrete researchable benchmarks.

Teachers' beliefs about various academic disciplines, student development of higher-level thinking, special student populations, and problem-based learning have also been researched. Again, a comprehensive review of all of this literature is not reasonable for this paper but a few of them deserve mention.

McWilliams's (2008) suggestions for "unlearning how to teach" (p. 263) parallel those for child-centered teaching, PBL and other nontraditional teaching methodologies such as Inquiry Based Learning and, while her four steps to good teaching are detailed earlier, re-emphasizing her findings that teachers need to move away from the belief that they must be "all knowing (and replace this belief using a) 'meddler-in-the-middle' (approach that) positions the teacher and student as mutually involved in assembling and dis-assembling cultural" (p. 265) concepts to be taught.

Misco and Patterson (2007) examined academic freedom and how the perception of teaching controversial issues in the classroom may cause some teachers to believe that minimizing controversial issues benefits learning by eliminating student disagreements, hurt feelings, and/or disruptions. Misco and Patterson (2007) conclude their research by suggesting that more research is needed:

> In summary, academic freedom as educational freedom is a necessary condition for the teaching of controversial issues, and the teaching of controversial issues is an imperative in a democracy. Yet, students have rare opportunities to engage in such conversations and teachers themselves encounter numerous barriers in using controversial public issues in their classrooms. We would like to understand the scope and nature of these barriers, with the initial assumption that teachers have little understanding of what their freedoms are, and that this lack of understanding contributes to their decisions about teaching controversial public issues.

Thus the realities of the classroom, while illusive in teachers' belief research, play a major role in what can and what is taught. Wilson, Konopak, and Readence (1994) point this out clearly in their study of pre-service teachers' beliefs and practices in a secondary

social studies classroom. They emphasize that theories of instruction and practical realities in the classroom create inconsistencies between teachers' beliefs about the discipline of social studies and its instruction. Additionally, time constraints provide concerns when implementing or trying to use new methodologies. Wilson et al. (1994) explain that the pre-service teacher "did not have sufficient time even to cover the text material" (p. 377). Adler (1991, p. 214) adds: "pre-service teachers seem, by and large to take on a managerial mentality, to use the trial-and-error to determine what works and to define what works by what keeps the class running smoothly."

Earlier discussion of social studies linked it with democracy, citizenship and high levels of learning because of its multi-disciplinary nature. Because of this, it can be seen as not a real academic subject (Adler, 1988) and it can have a discounted curriculum, lower than Math and Reading (NCLB, 2002) and is not even assessed by some states, lowering its importance to teachers and students.

Similarly, geography is included as part of the themes included by the National Council for the Social Studies (1992) and has similar belief issues for teachers. Thornton (1989) in looking at criteria that teachers use for lesson planning for content, sequence, and instructional strategy in geography he found that teachers relied on memorization of "facts and skills" rather than an understanding of "relationships" (p. 20). Thornton (1989) identified three concerns for geographic curriculum reform that requires further study: (a) frame of reference that is interactive that can be seen as "too difficult" or "beyond students' comprehension" (p.20); (b) essential teachers' assumptions regarding learning, sequencing, and geographic knowledge are not examined, discussed or used for educating teachers; and

(c) major effort is required to support and assist teachers to go beyond recitation of fact and skills and to understand the educational impact on students.

More research has been done on teachers' beliefs in the mathematics and reading because of the public policy emphasis of placed on them by NCLF (2002). Barlow and Cates (2006) in a pre- and post-survey using math teachers, indicate that problem posing in mathematics classrooms also shows positive responses from the teachers. This is also a movement away from the teacher as the "teller of information to one of questioner and listener" (p. 64). However, even in those disciplines that are emphasized for reform, a lack of knowledge of teachers' beliefs is evident. Ernest (1989, p ii) notes, "Official pressure for reforms in the teaching of mathematics overlooks a key factor: the psychological foundation of the practice of teaching mathematics, including the teacher's knowledge, beliefs, and attitudes." Barlow (2006) laments that, in spite of efforts to improve mathematics, there is a lack of emphasis on research on teachers' beliefs and pre-service teachers' myths remain evident.

It can be concluded that the need for the study of teachers' beliefs is not limited to the social sciences. Thus, it should not be surprising that there has not been a lot of research on teachers' beliefs about problem-based learning. However, Pepper (2009), promotes problem-based learning as a successful teaching and learning strategy when used to engage students in deep rather than surface learning and where the learning is student focused rather than teacher focused. Her research examines teacher beliefs that require the teacher to be the knowledge bearer. Pepper (2009) examines a university professional development Science Faculty development on PBL to both improve student engagement and increase the

difficulty level of learning by students. She concludes that the PBL implementation was seen as successful.

However, Pepper (2009) noted a teachers' belief issue linked to the group processes used by problem-based learning due to lack of familiarity and the use by those involved in the development session. Pepper, supported by earlier references (Wilson, Konopak, & Readence, 1994; and Misco & Patterson, 2007), is further supported in her concerns regarding careful orientation of teachers into a facilitating role instead of a more traditional teacher-as-the giver of knowledge approach. Pepper (2009) found in researching the effectiveness of Inquiry-based Learning, a closely related teaching methodology to PBL, preparation of the teachers is needed so that teachers understand and expect to act as the facilitator or mentor to guide and encourage students through the inquiry process (Spronken-Smith, Bullard, Ray, Roberts, & Keiffer, 2008). This research, looking a teaching geography to university students, adds that students may also need this preparatory understanding of the process. This suggests that, while such teaching methods may be seen as effective, training for various components of the teaching methodology prior to implementation may be critical for success. In other words, teacher education may overcome teacher's beliefs when academic progress and good results have been demonstrated.

Another researched area of teachers' beliefs has included the teacher's responsibility for student development of higher-level thinking skills or critical thinking (CT). Torff (2006) found that teachers "rated both high-CT and low-CT activities as significantly more effective for high-advantage learners than low-advantage ones" (p. 39). This finding is also consistent with Raudenbush, Rowan, and Cheon (1993) along with Zohar, Degani, and

Vaakin (2001). Further, Torff (2006) found that teachers are comfortable with providing fewer critical thinking activities for low-advantage learners than their high-advantage students. He also found that his research calls "into question the claim that teachers judge low-CT activities to be preferable to high-CT ones for low-advantage learners but that similar mixtures for both groups are not indicated" (p.39). His study divided teachers by experience in the classroom into expert teachers, who have the most experience, and in-service teachers, the group representing all levels of experience, and found similar results for both groups. Toroff (2006, p. 47) says the implications for teacher education are twofold:

> First, initiatives are needed to further discount the effectiveness of low-CT activities for both high-advantage and low-advantage learners…Second, research and practice for low-advantage learners.

The need for additional practice, research, and education for teachers is also supported by Pogrow (1990, 1994), Raudenbush et al. (1993), and Zohar et al. (1993).

To conclude the section on beliefs, the comparison of traditional classroom and PBL classrooms requires a discussion and definitions from theory and that also include observation and feedback from the teacher. Also potential impact(s) of these beliefs on standardized testing are critical. For purposes of this research, teachers' beliefs will be defined as written and/or verbal comments from the teacher that describe how she defines and understands her role as teacher, the classroom, and her students (Pajares, 1992). Additionally, the following categories, discussed and defined earlier, have been seen as essential issues for this research:

A. Teacher-led instruction versus student-centered and individualistic learning (Schrand, 2008);

B. Lower expectations for some students, the classroom, and/or the school or district (Ferguson, 2003; Norguera, 2003; Richardson, 2003; and Dweck, 1986);

C. Student abilities in specific subject areas that require specific methodologies such as the teacher reading instruction to student with low reading scores (Bloom, 1981; Fletcher, et. al., 2010Gersten, et.al., 1988);

D. "Confusing" students with an interdisciplinary or broader lesson focus or emphasis on fact versus thinking (Jonassen & Land, 2000);

E. Gatekeeping functions, including limiting the scope of controversial subjects or recognizing the interests of students that are outside the approved curriculum to achieve a controlled learning environment free of distraction, confusion, and/or disruption (Wong & Wong, 1998);

F. Providing a caring classroom environment where students feel safe to express ideas (Banks & Banks, 1992; Delpit, 1997; Freirie, 2005; Gay, 2000; and Ogbu, 2003).

G. Teacher/school/district resistance to change (Abelson, 1979; Buchmann, 1984, 1987; Buchmann & Schwille, 1983; Clark, 1988; Florio-Ruane & Lensmire, 1990; Ginsburg & Newman, 1985; Lasley, 1980; Lortie, 1975; Munby, 1982; Nespor, 1987; Nisbett & Ross, 1980; Posner et. al., 1982; Rokeach, 1968; Schommer, 1990; Van Fleet, 1979, Wilson, 1990).

Problem of Defining Academic Success: Empirical, Political, or Social?

One of the contextual concerns defining academic success or failure, particularly outcomes reported from standardized tests, concerns equity. Research defining academic success and failure is not new. These theories suggest that the classroom environment is

one of the major determinants of academic success. The issue, while complicated, asks a basic question: "*Who* should be educated?" then asks a more politically pointed question of "What kind of education is needed?" Orlich (2006) in his book, *School Reform: The Great American Brain Robbery*, asserts that the United States has the only school system in the world that provides a free education for all its citizens. While he goes on to criticize the recent impact of NCLB (2002) along with the emphasis on assessments with what he sees as a brain drain for urban and low-income schools due to disappointing scores, he commends the popular American expectation of educational opportunity for all children. He notes that this factor makes the American educational system stand out as exemplary. What may be politically important may no longer be whether a child *deserves* an education, but rather whether that child can receive the education he/she *needs* from American schools.

Without the necessity of detailing ongoing controversies regarding how to properly assess learning, it is important to note that certain disciplines are being emphasized in our schools. The Center of Education Policy (2007, p. 212) reports that:

> A majority of the nation's school districts report that they have increased time for reading and math in elementary schools since the No Child Left Behind Act became law in 2002, while time spent on other subjects has fallen by nearly one-third during the same time

Moreover, this same report observes that, "What gets tested gets taught" (2007, p. 2); and it impacts underperforming schools or schools that had been identified as needing improvement under NCLB (78%) more than schools that were not seen as struggling (57%).

The problem of how to define student achievement and how to improve learning "has been the subject of controversy and discussion from Aristotle forward" (translation by Barker, 1958, p. ii). In American public schools, early learning theories, such as those of Dewey (1944), have been used to stem the flood of criticism leveled at a public outcry for

increased academic performance for all students. Legislation with an emphasis on science and math began picking up momentum with the 1958 Sputnik scare during the Cold War. At that time, federally funded curriculum such as "The New Math", were adopted by school districts all over the United States. Many argued that academic underachievement continued, however, and documented it through official government reports that outlined consistent patterns of American school failure. In 1983, *A Nation at Risk: the Imperative for Educational Reform,* a report from President Ronald Reagan's National Commission on Excellence in Education marks a first step in the current education reform movement in the U.S. which eventually led to controversial legislative initiatives such as NCLB (2002). The concern over achievement has been seen by some as impacting the ability of the United States to compete internationally. Moreover, it is pervasive, impacting quality of life and the economy.

Comparing American student achievement internationally, Darling-Hammond and McCloskey (2008) indicate that the United States ranks 35th in mathematics and 31st in science out of 40 countries on the Program in International Student Assessment (PISA) tests in 2006. This represented a decline by the U.S. from three years earlier. Darling-Hammond and McCloskey (2008) also reported that U.S. students had the lowest scores on problem-solving questions in all the disciplines tested.

However, discussion on a perceived statistical decline of U.S. students needs to consider that not all statisticians agree that there has been a documentable decline in all standardized test scores by American students. For example, Bracey (2002) in responding to an article written by Cohen (1990) about lower SAT scores argues that Cohen "misunderstood the nature of the SAT" and that this statistical miscalculation "pretty much

destroyed his (Cohen's) argument" (p.8). Bracey analyzed the demographic changes in those who had taken the SAT in 1941 and those who had taken it in 1990. He documents that the 1941 standards were set on 10,654 white students living in New England. These students were composed of an elite of 98% white and 61% male with over 50% attending private schools. In 1990, he notes, more than a million students took the SAT, 52% were female, 29% were minority and only 12% had attended private schools. Additionally, 30% of those reported family incomes of less than $30,000 a year. When Bracey compared groups of what seemed (to him) to be standard setters for the 1990 students, he found a small decline in the verbal score and a tiny increase in math, so he concluded that "SAT scores have changed little since 1951" (p. 53). As a result, if you compare elites with elites, little difference in academic achievement is documented. Supporting Bracey's argument, Berliner and Biddle (1995) take the argument that there was never a score decline, that today's students are "out-achieving their parents…" (p. 33), that U.S. students "stack up very well" (p. 63) in international assessments, and that the entire brouhaha over test scores is a right-wing fabrication designed to promote school vouchers. Orlich (2006), while agreeing with Berliner and Biddle (1995) regarding a manufacturing of a test score controversy by the right wing, argues that the American goal of providing a free education to all of its children establishes some responsibility for those students and raises some important social issues. Thus, if the goal for all American students is opportunity for an education, then social issues need to be addressed regarding those students that appear to be low performers on the standardized tests assessing all students. The following conclusions are important considerations regardless of perspective:

1. More American students, from diverse populations and backgrounds, are planning and attending college (2000 U. S. Census);

2. The urban, low income, minority, and English language learners are not performing as well as the traditional populations (Banks and Banks, 1992; Delpit, 1997; Freire, 2005; Ladson-Billings, 1994; Ogbu, 1994, 2003); and
3. Fewer women and girls are choosing to study Science, Technology, Engineer, and Mathematics (St. Rose, 2010).

Popham (2001) takes the issue of low achieving and disadvantaged students one step further and indicates that the problem is not minority or language status. Instead, Popham (2001) argues that the real issue is economic status. Moreover, areas of low-achievement vary by subject matter with more language arts test questions and less math questions linked to economic status. His research, using the five national standardized achievement tests using an item-by-item review of two national tests, one for each grade level determined that the highest links to economic status on standardized tests were Language Arts (65%); Science (45%); and Social Studies (45%). Answers in these disciplines are more likely, according to Popham's (1999) research, to be answered correctly by affluent and middle-class students.

More recent research links quality child care with sustained academic achievement even through high school (Wang, 2010) but cautions that these results might also be linked to the ability to provide a better overall learning environment. More recent research indicates specific parental concern over effective reading instruction. While the study identified parental recognition of their responsibility for motivating their own children to read, it also identified concerns about the degree schools were meeting reading needs for students. This same study also identified the importance of effective home/school partnerships; the surveyed parents sought external assessment and support for 10-12 year old students for reading (Fletcher, Greenwood, & Parkhill, 2010).

Current research has also shown that children in poverty are academically disadvantaged due to the limited extent and quality of their social and educational relationships. Research examining educational relationships between children and adults in out-of-school activities demonstrate that an increased number of quality educational relationships increase the chance of success for academic achievement and rewarding employment (Wikeley, Bullock, Muschamp, & Ridge 2009). Relationships between students and educators, whether formal or informal, bring a greater understanding both to the students and to the educators. Additionally, these relationships provide insight into student perceptions about curriculum and their own education.

These research conclusions point to additional research that cautions against discounting student perceptions, particularly those of higher achieving African American students. Not providing opportunities for discussion of academia can place too much emphasis on the debilitating culture of poverty according to Freire (2004). Thus, emphasis on the need to include student voices in discussions and implementation of school reform is also vital to identify school content and procedures that high achieving African American students indicate contribute to their academic successes in spite of these recognized obstacles (Wiggan, 2008). Newer research shows that engaging in dialogue with students about their social environment "acknowledges the intense emotional experiences that students bring" with them into the classroom and "…are likely to reinforce the very stereotypes that lead students to reject whey they often see as demeaning education" (Knaus, 2009, p. 133). Moreover, Knaus suggests the importance of identifying student perceptions of academic disadvantages and acknowledging them publically because they may also lead to increased/decreased student engagement and students' willingness to try. Some students

may not be motivated to expend the effort needed to succeed in school because they experienced failure early. Such students, according to additional recent research, may feel that "intelligence levels are stable through life and that changing this initial assessment of their abilities and intelligence is not possible" (Dolan & McCaslin, 2008, p. 2425). Glenn (2010), in a interview quoting Dweck, supports Dolan and Maslin's conclusions He reports that Dweck suggests that in place of quantifying intelligence scores for students, it is more beneficial to praise students for their work and their persistence—things the student can control, such as personal effort—and minimize uncontrollable factors such as poverty.

On the other hand, research on classroom instruction has generally moved away from supporting lecture or whole class instruction in the belief that lecture, memorization, recitation, and stand-and-deliver instruction that emphasize public evaluation and encourage comparisons among students may discourage low-achievement students.

This research leads into a discussion of student engagement, or the interest of students in the topic and the willingness to stay on-task while learning is supposed to be taking place. This, like teachers' beliefs and quality teaching practices includes a number of components.

For example, negative evaluations can cause some students to become disengaged because they want to avoid negative comparisons. Kelly and Turner (2009) indicate that because whole-classroom instruction is the predominant instructional method in American schools, such a sweeping judgment may not be accurate because "many relationships between motivational climates and levels of engagement have been clearly documented, we find no conclusive evidence of a link between whole-class instruction and disengagement among low-achieving students" (p.1665). Conversely, Raphael, Pressley, and Mohan

(2008), in a study of instructional practices, teacher interviews, and student work in the classroom compared highly engaging, moderately engaging and low-engaging teachers and found the highly engaging teachers used multiple instructional practices such as scaffolding and encouragement of strategy-building processes by students.

Also, these teachers did not express frustration; provide answers that were unclear, or anything that had the potential to discourage student engagement. Thus, examining such criteria as student perceptions or feelings about the classroom and of a teaching methodology is a vital part of analyzing teaching methods.

Overall, it is a mistake to indicate that lack of academic success is limited or confined to only minority or poor students. For example, gifted students, typically overlooked in today's budget-strapped curriculum, may be advantaged in classrooms that differentiate or individualize learning (Chval & Davis, 2009). Of even great importance, recent research indicates, "teachers who differentiate learning with meaningful tasks for students at all levels can keep their entire class engaged" (Chval, et al. 2009, p. 267). Additionally, according to Chval, et al. (2009, p. 269) the things students considered most important were:

1. Respect; Engagement;
2. Challenge; and
3. Opportunity for creativity and flexibility.

Similar student perceptions were also documented for students in an alternative high school for disengaged students with academic potential published by Schussler (2009). However, Schussler also added that the perception of opportunities for success and that the teacher believed they were capable of learning. Additionally, Schussler adds that

perceptions of opportunity lead to being understood and when the learning conveys excitement and is relevant.

Finally, Ten Steps to Better Student Engagement were outlined by deFrondeville (2009). They are:

1. Create an emotionally Safe Classroom;
2. Create an Intellectually Safe Classroom;
3. Cultivate Your engagement Meter or notice the quality of engagement;
4. Create Appropriate Intermediate Steps or make sure all students are successful;
5. Practice Journal or Blog Writing to Communicate with Students;
6. Create a Culture of Explanation Instead of a Culture of the Right Answer;
7. Teach self-Awareness About Knowledge or build on prior knowledge;
8. Use Questioning Strategies That Make All Students Think and Answer;
9. Practice Using the Design Process to Increase the Quality of Work or use draft and revision to increase quality of student work; and
10. Market Your Projects; relate projects to the real world; answer why the project is important (The George Lucas Education Foundation, 2009).

Various groups, including community colleges, have documented increasing use of student feedback on what engages students and are encouraging students to express their perspectives (McClenney, 2009). For example, in encouraging community colleges to respond to students concerns, poor results in educational attainment comparing low-income and students of color revealed needed changes to increase "purposeful educational experiences, ability to attain key milestones, certificates, and degrees" (McClenney, 2009, p. 20).

Research by Lim (2008) examined student perspectives on the use of technology, academic engagement, and global challenges for the future of education. The study found that students felt that school often restricts their access to technology when they compared to what they could access at home. Thinking beyond the use of technology in school, Lee and Spires (2009) found that technological education is significant at all levels for students because it is "becoming a currency of sorts for citizens in society" (p. 62). While the use of

any technology was "fun", restrictions did impact their interest is coursework and their academic engagement. Students also noted that they were concerned about the global economy and being "left behind". Finally, emphasizing the importance for student involvement in their own education, the Spires et al. (2008, p. 512) article cites Prensky's (2006) assertion that, "Kids are training themselves—in the absence of anyone doing it for them—to be ready for the world of the twenty first century." Thus, it is important for schools to have up to date technology that works if student engagement is a classroom goal.

Furthermore, some of the most recent research on technology does not support the belief that mobile games enhance pupil learning (deFreitas, 2006) or motivation to learning. Hulzenga, Admiraal, Akkerman, and ten Dam (2009) indicated, "No significant differences were found between…two groups with respect to motivation for History or the Middle Ages" (p. 332). Interestingly, Judson (2006) suggests that it may be more than inspiring student interest though new technology that is needed. Judson (2006, p. 581) notes that in some cases there was a disconnect between teachers' belief and practice:

> Research indicates that teaches who readily integrate technology into their instruction are more likely to possess constructivist teaching styles. Evidence the nature of the teacher's technology-integrating lessons…Unfortunately, much of the research to date has relied on self-reported data from teachers and this type of reveal a significant relationship between practices and beliefs. Although most teachers identified strongly with constructivist convictions they failed to exhibit these ideas in their practices.

In summary, the theories and literature suggest that the classroom environment, based on teachers' beliefs, is one of the major determinants of academic success, particularly in the standardized testing arena. Contingent issues that heavily impact that environment include such basic observable components including student perception of how safe the classroom is for open discussion, whether the teacher and other students are supportive,

whether incorrect answers are tolerated, whether thinking beyond the text or typical answers are encouraged, and whether the curriculum is tied to student real world experience.

PBL's Impact on Standardized Tests

Research, using primarily qualitative teacher classroom observation that does not compare standardized tests, has not shown that PBL increased traditional acquired knowledge, defined as knowledge typically tested by standardized assessments, when compared to the traditional classroom. Studies have not been done comparing the traditional classroom with standardized tests. Other studies have shown that PBL does increase retention, application, and motivation. This analysis summary of empirical studies on PBL and academic achievement is supported by McKeachie and Svinicki (2006). Little, if any, research has been done comparing standardized tests.

The recognition that PBL appears to create a link to previous knowledge, recognized earlier through observation, caused problem-based teaching to be recognized and adopted for teaching by the Harvard Medical School in the nineteenth century. Other PBL-oriented teaching processes include Dewey's (1944) progressive learning, Bruner's (1990) discovery learning, and the development of simulations in the 1960s (McKeachie and Svinicki, 2006). While not shown to increase or decrease standardized test scores, they have shown that PBL instruction can enhance learning. For example, the studies by McKeachie and Svinicki (2006) were based on a survey of college and university education students. This research was based on the teacher's assessment of learning in the classroom and not through standardized testing. Other research by Darling-Hammond and McCloskey (2008) examining authentic assessment methods demonstrated increases in skill development and the ability to use new knowledge. However, these were not standardized. Thus, what has

not been clearly demonstrated by these studies is whether PBL can increase scores on traditional standardized tests based on the adopted standards at the K-12 level. While a relationship to learning improvement is generally accepted, the PBL's relationship to achievement on standardized tests has not been established and it has not been compared to differences in learning in the traditional classroom. This relationship is the primary focus question to be examined by this research.

Comparing the American approach to teaching and assessment with that of the international approaches, Darling-Hammond and McCloskey (2008) are clear about the benefits of both problem-based teaching and the use of performance-based assessments. Taken together, PBL teaching and performance-based assessment, have the benefit of integrating curriculum, instruction, and assessment. Such integration with specific focus on student learning is shown to improve student achievement according to Popham (1999) although he stops short of endorsing performance-based tests over those he identifies as quality standardized tests. The combination of PBL with performance-based assessment, as outlined earlier, has been shown to improve performance. However, the argument can be made that the assessment, having been designed for PBL, may be biased. Thus, coupling PBL with standardized test scores in this research has the potential to demonstrate traditional academic assessment and eliminate what may be seen as a bias.

While I have highlighted what Darling-Hammond and McCloskey (2008) have described as the high-achieving international process, these methods have not been totally lost by the United States. The National Science Foundation has encouraged performance assessments and hands-on science and math assessments since the 1990's and prototypes

using PBL exist in the U.S. in Connecticut, Kentucky, Maine, Nebraska, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

Additionally, PBL has been shown effective by a few U.S. studies although not specifically on standardized tests. Much of the research done in the U.S. on authentic problem solving, another name for PBL, has been in the disciplines of math and science. This research is focused on elementary and middle school levels. One such study, a qualitative thesis by Abdullah (1998) on kinesthetic teaching techniques and out-of-class activities to present course information to college students, involved theory into practice and development of personal and social skills. He found that social skills were increased using PBL teaching methods. Theorists researching mathematic instruction who support PBL include Kanter (1999) with the U.S. Department of Education of Educational Research and Improvement. This report was published both in English and Spanish. In 1992, Kanter examines PBL using mathematics for children aged 5 – 13, however, this study did not involve standardized testing.

Other researchers have focused on team, group, or cooperative learning, typically used in conjunction with PBL (Weikart, 2002; Silberman, 1996; Ulrich, 2005; and Negeow, 2001). Smith (1998) and Laitsch (2007) talk about the importance of utilizing play and its group focus for elementary student learning. These researchers establish the link between cooperative learning and student knowledge extended beyond the traditional classroom teaching methods but fall short of examining these extended benefits to standardized testing.

In summary, the literature review, while delving into vital background and supporting research, focuses on achievement based on observation and opinion and not on a comparison of standardized tests linked to PBL and traditional classroom teaching

methodologies. Obviously, PBL cannot be narrowed to only one factor that lends itself to a quick analysis that can be defined by only one component or even a single classroom lesson. Rather, PBL is a instruction that is fluid and encompasses not only a number of differing academic disciplines but also provides a prolific source of links for prior learning that has the potential for individualized knowledge with which any student may find prior links along with higher-level thinking challenges. From the theory cited in the literature review, this should provide an advantage for the learner but it has not been tested quantitatively.

Major issues for this research—and those that emerge from them—are dependent upon theory identified in the literature review. Issues include the establishment of a clear understanding of the differences between observed PBL teaching methods and those traditional methods used in the experimental classrooms; determining whether there is a relationship between either teaching method and the tested academic disciplines; a determination of differentiated student learning on special populations; the effect of observed teacher beliefs and understanding of PBL methods; observation of student engagement; and evidence of a relationship of the researched teaching methodologies to higher-level thinking skills. Important issues have been discussed in this literature review that raise specific questions for research. These questions, designed to be examined in the study, are:

1. Generally, were there differences in the aggregate scores when pre-test and posttest scores were compared? Looking at the groups separately, did those differences still remain consistent?

2. Were there differences between the groups when the level of difficulty of the questions was taken into consideration? Did this show student development of higher-level thinking?
3. Were there differences in the standardized test scores demonstrated between the groups when grade level standards were examined? In other words, were students able to construct new meaning?
4. Were there differences in the standardized test scores between the groups when the standardized questions were separated by academic discipline? In other words, did students learning expand to include more than one academic discipline?
5. Were there differences in the standardized test scores for students that were English Language Learners or minorities?
6. Are there differences shown in the classroom by student engagement in the lesson? In other words, are students' "on task" and for how long?
7. Are there differences in learning enhancement identified by students and the teacher?
8. Are there differences in the types of knowledge students' felt they gained from their classroom experience?
9. Are there differences in attitudes and feelings about teaching/learning concerning civil liberties and social/community issues?
10. What are teacher beliefs regarding PBL and/or the learning capabilities of the classroom groups and the participating students? Is there evidence that these

beliefs impacted student behavior or achievement on the standardized test scores?

CHAPTER III

METHODOLOGY

This research compared differences between standardized test scores in a traditional classroom and those from classrooms that participated in a problem-based learning (PBL) approach for one week. This research used a type of mixed-method, quasi-experimental comparative pre/posttest design, and qualitative methods mixed-method, quasi-experimental comparative pre/posttest design, and qualitative methods. It involved five (5) social studies classrooms. One teacher taught all five (5) groups used in this study for one week. In four (4) of the classrooms, the teacher taught using the PBL intervention created by me (The Balloon Race, Appendix 3). In the one control classroom, she taught in her traditional way using her own lesson plans and work sheets roughly covering the same material being covered by the intervention classes. At the beginning of the week and at the end of the week, we administered the test in Appendix 7, standardized test questions developed by CTB, McGraw Hill (2002) chosen to evaluate learning taught for the week. For the study, permission was required from the teacher, students, and parents. The following Table shows how many students had parental approval, how many students gave their own consent, and how many took both the pre- and posttest:

Table 1: Subject Population Breakdown Leading to Number of Participants

Group	Group Population	Parental Consent	Student Consent	ESL	Minority Population	Pre-tests	Posttests	N
1	26	15	26	0	7	15	15	15
2	27	11	27	1	4	10	10	10
3	27	16	27	2	6	12	12	12
4	27	19	27	2	6	16	16	16
Control	24	12	24	2	4	8	9	8

As a result of the small number of parental approvals, the samples were too small for statistical analysis. However, regression analysis and selected individual and classroom interviews, video, taped recordings, and teacher questionnaires provided data for results. These results showed that the control group actually had more improvement than the others on basic knowledge and memorization while the PBL groups did as well or better than the control group on the more difficult questions.

A mixed-method approach in social science and used by this study is designed to incorporate the features of more than one analytic method. Quasi-experimental design, which includes multiple design approaches (Shadish, Cook & Campbell, 2002), is one of the research design methods that can be included in mixed-method research for the social sciences. It is justified when the research shares characteristics of true scientific experiments that use interventions or treatments. While quasi-experimental methods are an empirical approach, they may lack random sampling or random assignment of subjects. This study does not contain either. According to Greene (1991) this offers "insights that are deeper and broader, and to develop important knowledge claims that respect a wider range of interests and perspectives" (p. 251). Greene (1991) explains that tensions between the methods and any points of conflict between the results comes not from removing the tensions but rather to achieve deeper understanding without necessarily resolving any conflicts. Technical arguments for using mixed-methods, according to Greene (1991, p. 252) are:

> First, because social phenomena are so complex and social problems so intractable all of our methodological tools are needed for understanding and for action. Any single method by itself can render only partial insight from but one perspective…The second mixed-method argument …underscores the essential interdependence of different methods in all of our claims to know.

The purposes for using mixed-method, according the Greene (1991) are for: (a) triangulation to attain convergence, corroboration, and communication of data across the methods; (b) greater elaboration, detail, and to make results clearer and/or differentiated (c) development designs created for longevity; (d) extending the range of inquiry; (e) initiation designs for emerging concepts and more creative interpretations. This research follows what Greene (1991, p. 252) identifies as an integrated mixed-method design defined as:

> a synthesis that is planned and implemented during the processes of data gathering and analysis rather than at the stage of inference. So in the creation of this synthesis, markers of the individual methods are blended and their discrete identities left behind.

Because of the nature of the research, major identifying characteristics of the diverse research methods (qualitative and quantitative) were emphasized for comparison to allow more important findings to be blended and better understood. Greene (1991, p. 257) describes this as:

> the fundamental mixed-method rationale of understanding more fully…by planning, implementing, and analyzing the result of different methods separately and then combining these results into overall study inferences.

Greene (1991) cautions that mixed method should not be used when resources are limited or when greater understanding is not the most important aspect of the study. The two methods used by this study are modified for quasi-experimental design without random sampling. Qualitative coded data using major codes shown in Figure 1 with the result outlined in Table 17 and Table 18 also uses narrative detail to enhance understanding and provide analysis of the quantitative data results. The mixed-method design of this study also takes advantage of definitional differences established by Ross, Cornett, and McCuthcheon (1992) between traditionally process-product research, where differences are identified from outside sources, such as standardized tests and also where discrete events and behaviors in

the classroom can be videotaped, documented, and also where statistical generalization can be made from the aggregate data. These data sources define interpretive research as analysis of the holistic learning environment.

The need for exclusive emphasis on statistics and its dependence on large numbers for significance has been debated outside of education and has been a focus of concern in all the social sciences, including psychology and political science. Questions such as how large a subject population had to be, if mixed method was used, should qualitative or quantitative approaches be primary; or when disciplines such as psychology and political science were combined, should one discipline lead while the other discipline followed; and, finally, could these research methodologies be respected as scientific research? Almond (2002, p. 72) addresses this question and concludes that combining the research methodologies used by other disciplines could hold "special promise." Specifically, he reflects on the concerns of Merriam (1924, p. 182-183) regarding confusion and the mixing of established research methods and their use outside the established discipline:

> It may be said that the lines of inquiry suggested are not appropriate for political scientists, because they carry us out of our accustomed territory, and we may be lost in the desert…[A] certain number of explorers must always be lost, especially if they advance too far or too fast…What we are really striving to achieve is neither psychology nor psychiatry as such, nor biology as such, nor history as such, nor economics as such, but the development of scientific method in the observation, measurement, and comparison of political relations.

From these (and other) concerns, according to Almond (2002, p. 12), "more sophisticated literature on methodology began to flourish." Almond (2002), while cautioning against value-neutral conclusions, suggests that missing accepted research methodology provided more realistic conclusions. Eckstein (1975) used case studies to de-emphasize the statistics and the necessity for large numbers. George and Bennett (1997)

used statics in combination to provide complementary results. King, Keohane, and Verba (1993) and Collier, (1993) began adapting both large and small number situations and environments for research. All of these have been precursors to a mixed-method approach to social science research.

Quasi-experimental design, one of the research designs that can be used in mixed-method research for the social sciences, is justified when the research shares characteristics of true scientific experiments that use interventions or treatments. While quasi-experimental methods are an empirical approach, they lack random assignment of subjects. Using a quasi-experimental design is more appropriate when randomization is not practical and when subjects that are already naturally organized like they are in the existing school classrooms are compared. Further, using a quasi-experimental design limits threats to external validity, since it is an experimental model. Thus, it may be applied to other subjects and settings, allowing for some generalizations to be made about similar populations. A final benefit of quasi-experimental design is that it can be extended longitudinally over time and thus is capable of being followed-up for examination in different environments after the initial experiment. For this study, this was an advantage since additional research is expected.

The disadvantages of the quasi-experimental design are that the control of the independent variable, due to lack of randomization, may lead to internal validity concerns. Statistical significance, defined as the "probability that the results of an experiment were due to change" (Neale & Liebert, 1973, p. 19) can be obtained while the ability to generalize results to another population could be suspect. In other words, the research results may not be able to be generalized outside of the initial sample. Educational researchers such as

Shaver (1992, Abstract, i) stress the importance of random selection, already noted as missing in this design, over a quantitative finding of statistical significance:

> because it insures the independence of observation that is important for the social sciences, but it does not guarantee independence beyond the initial sample selection. A test of statistical significance provides a statement of probability of occurrence in the long run, with repeated random sampling under the null hypothesis, but provides no basis for a conclusion about the probability that a particular result is attributable to chance.

Shaver goes on to point out that a test of statistical significance, or a finding conclusion that the result was not caused by chance, provides probability of occurrence that can be generalized in the long run with repeated research using a random sample. However, according to Shaver (1992), even random selection does not guarantee independence beyond the initial sample selection. Shaver goes on to point out that a test of statistical significance provides probability of occurrence that can be generalized in the long run with repeated research on a larger population. Some knowledge about the data can be approximated without loss of internal validity, but cause-effect conclusions are difficult to determine. Even when causation appears clearly identified and assessed, causation cannot be firmly established, because the experimenter does not have the required control over the variables. Thus, causation cannot be determined even when randomization is present using other social science methods due to potential challenges concerning external validity. This study does not include randomization because the already established classrooms prevented re-organization and were initially randomized by the classroom selection process of the school. However, the subject reduction created by limited parental consent letters and a few students missing either the pre-test or the posttest eliminated any claim to randomization.

In spite of this, quasi-experimental design does provide results that may be generalized, although with caution, when repeated experiments are made. Thus, while these

results are only in a snapshot or one-time result, the number of groups does provide some support for tentative conclusions. However, repeated experiments are needed. To make the results of this experiment as dependable as possible, because of the concerns about internal validity, and also because of the need to identify as many possible causes for the results as possible, both qualitative and quantitative research data was employed to analyze the data results.

Data using both qualitative and quantitative methods were collected and analyzed. Quantitative analysis using regression of the standardized test results demonstrated differences between the treatment and research classrooms. Additionally, simple regression of the level of difficulty for each question, established by CTB (2002), compared incorrect individual student scores on the pre-test with individual corrected answers on the posttest and analyzed them as a group aggregate. Further analysis was used to determine if a hierarchy of disciplines was present. Academic questions were separated by discipline according to CTB designations based on national and state standards for each grade level (Figure 2). Table 14 shows the percentage of student corrected scores compared on the posttest to determine if one discipline was more advantaged than any of the others. Analysis of non-standardized learning and progressive issues outlined in the literature review used qualitative data from survey, interview, observation, and student work from all four 6th grade experimental classrooms and the one control classroom. Results comparisons and conclusions in the Discussion of Results section were developed from descriptive statistics, coded data developed into matrixes in Tables 17 and 18, and from observation and survey data expanded into a narrative, revised continually as the data was collected (Connelly & Clandinin, 1990) in the Results section. Detail by groups and other research-identified

categories further expended the data. Student and teacher surveys are included as Appendix 5. The protocol for teacher and student interviews has been included as Appendix 6. The pre-/posttest has been included as Appendix 7. The same test was used for both pre-test and posttest. Correct answers were never provided for either students or the teacher until after the study was completed.

Detailed qualitative coding to determine relevant issues were used to identify relevant issues relevant to the quantitative data. Major codes were developed from the literature review and then expanded as needed to further understanding of the results. The initial code list, Figure 1, is as follows:

Major Emphasis	Sub-emphasis Observed from Major	Emerging Issues	Source
Code 1	Code 2	Code 3	
A. Differences between PBL and Traditional Teaching	a.. Alternatives/differing viewpoints/permission of incorrect answers/ time to answer/ rubrics/ responsibility left to students		Ennis, 1996
	b. Examples/evidence/consensus/ promoting student perspectives		Paul & Elder, 2008; McClenney, 2000
	c. Use of cooperative learning/teams/groups/holistic approach/emphasis on social & community		Jonnassan & Land, 2000
	d. Interdisciplinary lessons		Jonnasson & Land, 2000;
	e. Recognition of individual student learning styles		Bruner, 1990; Blumenfelt, et al., 1991; Cook, 2009
	f. Meaning derived from culture/students training themselves		Schrand, 2008; Gardner, 1993; Rittell, 1984; Jonnasson & Land, 2000; Spires, 2008; Dewey, 1944

(continues)

Major Emphasis	Sub-emphasis Observed from Major	Emerging Issues	Source
Code 1	Code 2	Code 3	
C. Higher-level thinking skills/Critical Thinking	a. Greater depth of knowledge or meaning b. New understanding/knowledge		Paul & Elder, 2008
D. Student Engagement in the Lesson	a. Respect and Engagement defined as time on task, student acceptance of challenge/ opportunities for creativity		Chaval & Davis, 2009;
	b. Emotionally & Intellectually Safe Classroom		DeFrondeville, 2009
	c. Emphasis on explanation instead of the right answer		DeFrondeville, 2009
	d. Performance-based classroom assessment	i. Ability to Use Knowledge	Darling-Hammond, et al., 2008; Smith, 1998; Rogoff, 2001
	e. Use of play		Laitsch, 2005
	f. Multicultural lessons/cultural inclusion	ii. Enjoyment	Gay, 2000; Freire, 2005; Rogoff, 2001
		iii. Relevant learning	
E. Teacher's Beliefs that Impact PBL Implementation or Standardized Test Differences	a. Depth in lessons that develop knowledge to apply to new situations	i. Feelings about PBL	Bereiter, et al,2005;
	b. Inconsistent approaches/ inquiry-oriented approaches/constructivist approaches to teaching/emphasis on facts or thinking?		Prawat, 1992
	c. School culture	ii. Perspective on teacher-led instruction	Evans, 1990

(continues)

Major Emphasis	Sub-emphasis Observed from Major	Emerging Issues	Source
Code 1	Code 2	Code 3	
F. The Learning Environment (Classroom)	a. Quality childcare/affection b. Strong classroom management/lecture/whole class instruction c. Multiple instructional approaches d. Building on prior knowledge	 i. Teacher expectations ii. Gatekeeping functions iii. Need for special instruction	Wang, 2010; Wong, 1998; Kelly, et al., 2008; Raphael, et al., 2008; Bruner, 1998; Ladson-Billings, 1994; Flinders, 2004
G. Negative Comments and Comparisons/Student Encouragement			Kelly et al., 2009; Raphael, et al., 2008
H. Need for Teacher Education (In-service)		i. Knowledge of PBL ii. Knowledge of different teaching methods iii. Defining a caring classroom iv. Resistance to change	Pepper, 2009
I. Teacher Overload/Distraction or lack of time to prepare due to the demands of high-stakes testing		i. Effective use of limited class time	Popham, 2001

Figure 1: Major Code List for Qualitative Analysis

All data was divided into subcategories, including special populations such as race and English Language Learners. Analysis of the five disciplines included in the research intervention and standardized tests were added to the comparison between the traditional

and PBL classrooms. Coded data using initial themes adopted from the theories of Jonnassen and Land (2000), Lave and Wenger (1991), and Ennis (1996) using Excel software was used for the qualitative analysis of emerging data. Initial research themes identified were: (1) level of student engagement; (2) teacher beliefs about PBL (and the treatment or intervention); and (3) student prior knowledge developed from the pre-test results and teacher interviews. Other themes emerged as the study progressed and these were also coded in the qualitative analysis.

Level of student engagement was evaluated using observation, student interviews (Appendix 6, Student Interview Protocols), student work (Classroom Rubrics, Exhibit 3), and teacher observations (Appendix 6, Teacher Interview Protocols), Student prior knowledge was analyzed from the scored rubrics (Appendix 3), teacher observations obtained through interim interviews, and documented through the standardized pre-test administered and analyzed quantitatively. Teacher beliefs about PBL were determined using interviews, follow-up interviews throughout the research process, and researcher observation documented by video (Table 15, Matrix Outlining Most Frequently Cited Teacher's Beliefs). Outcomes from the research was analyzed in terms of the impact of the treatment (the intervention) on standardized test scores, relevance of learning to student obtained form student classroom interviews, student understanding, and development of higher-level thinking skills based on CTB categories of difficulty for each question. In spite of having taken most of the controversial issues out of the intervention at the request of the teacher, any increases in social/community awareness were also documented when found to exist.

The initial analysis was in aggregate groups using only the one control classroom and all four experimental groups as a comparison. However, differences in the number of students participating did not allow for significant statistical analysis. Also, it quickly became obvious that the four experimental groups were being treated differently in the intervention, the differing environments existed in the different classrooms, and that the groups themselves had readily identifiable and differing characteristics. For example, one class, the first class of the day, had a longer class period time than the other classes and had extra free time while another class was said to be "the better students" by the teacher. Thus, a research analysis to provide a second set of results that allow for comparison between the experimental groups and also between each experimental group and the control was important for discussion of the results.

Research Participants

The school district selected for this study has seen an increasing number of minorities moving into the district, from one-third of the population to almost half of the school population in the last six years (from Fall, 2003 to Fall, 2009), with the free lunch program in the district growing at the same rate. Standardized tests, such as ACT scores at the high school level are in the lower third for districts in the metropolitan area in which this district is located. Unlike a number of similarly situated urban schools, this school has almost no disciplinary problems. High school students in the district were among the state's top in athletics and music (Abouhalkah, 2010). A total of 135 students, with 27 students in each classroom, were initially randomly assigned by the school to the participating teacher. Research participants included sixty-one (61) 6^{th} grade students and one (1) regular classroom social studies teacher that used one (1) traditional classroom with eight (8)

participating students as a control and four (4) PBL classrooms with a total of fifty-three (53) students in separate experimental groups. The teacher described most of the students as low-functioning readers with limited writing skills.

This school is classified as an urban middle school where 40-50% of students are on the federal reduced fee lunch program, with a diverse student population including approximately 30% African American and 20% Hispanic. Much of the Hispanic population speaks English as a second language and some students are beginning English Language Learners. The students are mainstreamed as much as possible. None of the students in this study were identified as having an IEP or in need of special services.

However, not all students in every classroom agreed to participate in the study. The teacher reported that some parents had "refused to sign consent forms". Those students participated in the classroom activities for the Balloon Race but were assigned to separate, non-observed or documented teams, and were not included in the research analysis. Additionally, students who had consent forms but who were absent or who did not complete both a pre-test and a posttest were also excluded from the study. This had an adverse affect on randomization, noted earlier, and resulted in very small n's (subjects) for the study. This reduced statistical significance and validity of this study, making replication of the study necessary before anything more than preliminary or suggested results can be supported.

Participating subject populations (n's) were lower than hoped for and the control group had only eight (8) students that qualified for the study. This cannot be considered typical for the reasons mentioned above and also because the population, compared to the experimental/intervention groups, fifty-three (53) students is so much larger. The researcher decided to use two approaches for statistical analysis:

1) Compare the control group (N=8) with the experimental group (N=53) with the knowledge that statistical significance would not be possible but that overall descriptive statistics would show an aggregate result, albeit probably not statistically significant; and

2) Breaking the experimental group (n=53) into four separate groups (N= 15; N=10; N=12, and N=16) for analysis to increase the potential for statistical significance when compared with the control group and using regression analysis which is understood to not be generalizable to the larger population beyond this research but does allow for greater assumption that the effect was not simply chance for the smaller, researched, populations.

Additionally, by using each classroom as a separate group it was possible to identify differences in classroom environment, teaching methods, teacher/student progress, and observe if/how teacher perspectives/beliefs contributed to any differences. Comparisons could be made not only between the control group and each experimental group but also between each experimental group to the control, as well as comparisons between the experimental groups.

As noted earlier, five 6th grade urban classrooms were the subject population used for the study. Each of the five classrooms had an enrollment of twenty-seven (27) students in each class. In order to be included in the study, however, every student was required to have an approved Parental Consent Form and a signed Student Consent Form (Appendix 7). Additionally, each student needed to complete both the pre-test and the posttest. A large number of students did not return Parental Consent forms and some students, who did have consent forms, did not complete one of the two required exams. As a result, each of the participating research groups had differing number of subjects participating. The demographics for each groups is as follows:

1. Control Group Demographics

Initially, the research plan was intended to divide the classrooms into three experimental and two control groups. Or, better yet, to have two 6th grade social studies teachers participating with teacher using all five classrooms of his/her classrooms as the control. A second teacher would then use all five of their classrooms as experimental classrooms. However, one teacher declined to participate because of the heavy testing schedule that had to be completed before the holidays. The remaining teacher was concerned that some of her students would "miss out" on the intervention experience. However, she finally decided to use her "worst class" as the control classroom. When asked why she chose this group as the control, she jokingly explained, "Because the class was her most unruly perhaps because it only had two females, and was not inclined to want to study anyway." While the classroom had an enrollment of twenty-three (23) students, only thirteen (13) had signed consent forms and five (5) did not complete either the pre-test or the posttest. This left eight (8) participating students in the class. Demographically the participants were two (2) female, six (6) male, four (4) African American, and four (4) Caucasians.

2. Experimental Group One Demographics

Demographically, the class consisted of a total of twenty-seven students, with seventeen (17) having signed consent forms. Fifteen (15) students with consent forms completed both the Pre-test and the Posttest. Nine (9) of these were African American and none were Hispanic. The other six were Caucasian and none of these students spoke English as their second language.

3. Experimental Group Two Demographics

Of the eleven students turning in consent forms in group two, only ten (10) completed both the pre-test and the posttest. Demographically, they consisted of three (3) African Americans, one English as a second language speaking Hispanic, and six (6) Caucasians. Six (6) Group Two students were female and four (4) were male.

4. Experimental Group Three Demographics

This group had a total enrollment of twenty-seven (27) students with sixteen students returning signed consent forms from their parents. Only twelve (N=12) of those students completed both the pre-test and the posttest. Demographically, seven (7) of these students were male and five (5) were female; five (5) were African American, one (1) was an English as a second language-speaking Hispanic, and six (6) were Caucasians.

5. Experimental Group 4 Demographics

Demographically, there were twenty-six students enrolled in the class with nineteen returning parental consent forms to participate in the study. Of the nineteen, sixteen (16) completed both the pre- and posttests. The research group consisted of eight (8) males and eight (8) females; two (2) English as a second language learning Hispanics, four (4) African Americans, and ten (10) Caucasians.

Based on the fact that the school randomly assigns students to classrooms, a random sample assignment had been initially anticipated. However, as a result of the reduction in participating subjects, the attrition cannot be assumed to be random. Even if initial random assignment of those participating could be assumed, those participating in the groups could no longer be assumed to be equivalent across sex, race, economic backgrounds, etc.

Differences were noted in the demographics, prior-learning levels, teacher comments and observations of the groups, and environments observed. These differences might be attributed to the fact that only some students in each classroom qualified for research participation. For example, all classes had a non-white population that approximated half of the total class population. Only groups 1 and 4 had a higher portion of students that completed pre- and posttests. Yet group 4 had only six (6) non-white students that completed both the pre- and posttests. While this might or might not have had an impact on the results, it does bring into question whether the groups, even when separated, can be considered typical.

Other collected data included the pre-/posttest test design. The Standardized Test questions used by the study were used with the permission and guidance of CTB McGraw-Hill; Classroom Connections to TerraNova, the Second Edition (2002), using both grade 4-5 and 6-7. Forty-seven (47) scaled questions were chosen, ten (10) from the 5^{th} grade test bank, thirty (30) from 6^{th} grade, and seven (7) from 7^{th} grade level questions were chosen from the CTB test bank. Scores were totaled by each student' response then as a group aggregated then, finally, by the averages of the four (4) experimental groups and compared to the control group. The correct answers by students and groups designed by CTB (2002) for each of the academic disciplines, a nominal designation, being tested for each question were also compared descriptively. They were math, science, social studies, and language arts. Student grade level test scores, a nominal designation by CTB, based on the adopted national standards for grades 5, 6 and 7 were used to analyze student progress and to analyze differences both prior to the intervention as well as whether there were differences in posttest scores within and between the groups. Levels of difficulty, an interval scale, were

analyzed using simple regression to determine if there were differences identifiable within and between the groups for corrected answers at the various levels. These Levels of Difficulty, according to CTB "have many of the same characteristics as percentile ranks, but have the additional advantage of being placed on an equal-interval scale" (McGraw-Hill, 2001, p. 8.5) and were included along with discipline and grade level designations by CTB. No variation, improvement, or other explanation was added to the test bank questions provided by CTB. Students were placed in an exam setting by their teacher and expected to perform just as they would for the scheduled standardized tests used by the school district and State of Missouri.

Treatment, Design and Procedures

The quantitative portion of the research used a matrix research design created by the researcher using Microsoft Excel software for the district-assigned classrooms as the experimental and control groups. Codes were developed to initially code the most frequent issues found and categorized in the qualitative analysis. Groups were numbered consecutively beginning with the first class in the morning. Students were given confidential number assignments and categorized by number of each participating student in a group, type of minority students, those that speak English as a second language, and student achievement levels based on the classroom teacher estimation of skill level for each participating student.

An all day preconference observation and training session with the classroom teacher was held two weeks prior to the research. Additionally, copies of the Missouri standards which were to be tested by the research for social studies, communication arts, reading, mathematics, life science and science were provided to her along with the Student Study

Guide and the Teachers Instructions (Appendix 3). The teacher was asked to teach these standards to the control group as she normally taught them in her regular classroom. The teacher was also asked about her previous training or professional development in the use of PBL. She answered that she had been introduced to it in graduate level classes and used it for games she created for her own classrooms. She also said that she used Kagan's Cooperative Learning almost daily. The teacher was given all tools needed to teach the intervention unit and was given the opportunity to ask questions, make comments, and suggest changes. Finally, she was told that I would be available in the classroom during the study to answer any questions that might arise during the research and that there would be follow-up questions as needed, a written survey, and that videotaping of participating student teams was planned. Modification of seating and team assignments were adjusted to make certain that non-participating students were not included in the data gathering for the research. Due to district testing and other curriculum concerns, the research was modified at the teacher's request from 10 days to five days of research and the timeline between the pre- and posttest was limited to 5 days. Since the teacher had not yet scheduled lessons for all of the standards outlined and since the research was implemented mid-semester, the teacher expressed concern that students might not learn the new, untaught material. The intervention covered all of the standards adopted for the 6th grade social studies the adopted standards for the first half of 7th grade. Part of the research design included challenging students with new material to determine if they would be able to logically move from a lower level of difficulty to a higher level without specific teacher instruction based on their own interests. In spite of this, the intervention, based on teacher concerns, was modified to emphasize what she had taught, Ancient Egypt. In addition, she felt that students might

become overwhelmed and discouraged with a lot of new information. As a result, the amount and type of information was also reduced. Since the time allowed for the intervention had been reduced dramatically (50%), the artifacts required to be "picked up" by students were also reduced by half. While the intervention was modified based on the teacher's concern, much of the untaught standards not yet covered in class remained in place to allow researched assessment of new individualized learning.

Prior to implementing the intervention, all students were given the pre-test using questions chosen for the research from *Classroom Connections to TerraNova*, The Second Edition: A Resource Guide for Teachers (2002) pre-MAP assessment from CBT. The exam used has been included as Appendix 7. During the course of the five-day treatment, the researcher videotaped observation in all classrooms. Additionally, students' work from all classrooms was collected and analyzed. An interview with teacher occurred after every observation. Taped and spontaneous classroom interviews with students occurred on as-needed basis. Additionally, notes were taken using the protocols shown in Appendix 6.

At the end of the five-day implementation, the post-test was given to students. All students and the teacher were given a short verbal exit survey (Appendix 5) asking them to rate responses on teacher/student assessment of overall learning, interest, attention, and ease of implementation. The survey for students, due to time constraints, was not a written survey but rather a class discussion that was audio taped. Also, because the identical pre-/posttest (Appendix 7) was used in such a shortened schedule, the teacher and students were not given keys (answers) to the exam or told which answers they had missed on the pre-test.

Confidentiality

Participation in this study was strictly voluntary and confidential. All participants were described using a numerical identification with classes defined in terms of group 1, group 2, group 3, group 4 and control group only. Data collected from videotaping was stored on disc and student work and student tape recordings were securely filed where only the researcher has access. If a participant wished to claim the tapes of their own interviews after submission of the research results, the opportunity exists after the dissertation defense.

Every effort has been made to keep confidential all the information and data collected. Individuals from the University of Missouri-Kansas City Institutional Review Board (a committee that reviews and approves research studies), Research Protections Program, and Federal regulatory agencies may also look at any records related to this study for quality improvement and regulatory functions.

The Balloon Race Intervention

The PBL intervention, The Balloon Race was created as the teacher's final classroom assessment for 6th Grade students of Ancient History. As an unpublished classroom assessment, it was based on the state and national standards adopted for 6th grade in 2001. It was published as a Unit Lesson Plan as an example of quality student work at the University of Missouri at Kansas City and selected for the third place award for outstanding papers (Needham, 2009).

The purpose of creating The Balloon Race assessment (2001) was to encourage students to focus their strengths in an effort to provide learning opportunities for quality education. Additionally, effort was made to include new skills not typically seen in social studies classrooms. For example, Hinde and Ekiss (2005) suggest that geography has been

omitted or reduced by most of the state and district curriculum standards. Geography was an effective link to a number of other disciplines and was used as the central focus of the intervention. To further emphasize the adopted standards, the intervention matches PBL theories with teaching components examined by outside experts and aligned with The Balloon Race components as PBL. Alignment of the research intervention with problem-based learning theory is shown as Illustration 1.

State and national standards included in the intervention were developed from the adopted state and national curriculum by the State of Missouri. The 2004 State Standards for 6th grade communication arts, reading, math, science, social studies, and geography standards adopted as part of Theme III by the National Social Studies Council (1994) were also the performance measures used for the pre- and posttest research exam. A chart, Figure 2, showing the questions by discipline, level of difficulty, standard, and grade level is as follows:

Question	Discipline	Grade Level	Level of Difficulty	Standard
1	Reading/Language Arts	5th	1	Content
2	Math	5th	2	Content
3	Life Science	5th	15	Content
4	Science	5th	3	Recall
5	Math	5th	15	Problem Resolution/Reasoning
6	Reading/Language Arts	5th	15	Evaluate/External Meaning
7	Physical Science	5th	14	Construct Meaning
8	Physical Science	5th	15	Determine Accuracy
9	Social Studies	5th	14	Geographic Perspective
10	Reading/Language Arts	5th	2	Basic Understanding
11	Reading/Language Arts	6th	5	Identify Reading Strategies
12	Reading/Language Arts	6th	5	Identify Reading Strategies
13	Reading/Language Arts	6th	3	Analyze Text
14	Reading/Language Arts	6th	2	Basic Understanding
15	Reading/Language Arts	6th	4	Evaluate/External Meaning
16	Reading/Language Arts	6th	5	Identify Reading Strategies
17	Reading/Language Arts	6th	15	Constructed Response
18	Math	6th	12	Operational Concepts
19	Math	6th	11	Computation/Numerical Estimation
20	Math	6th	13	Measurement
21	Math	6th	10	Number/Number Relations
22	Math	6th	15	Data Analysis/Statistics/Probability
23	Math	6th	16	Patterns/Functions/Algebra
24	Math	6th	14	Geometry/Spatial Sense
25	Math	6th	13	Measurement
26	Science	6th	19	Science Inquiry
27	Science	6th	24	Personal & Social Perspectives in Science
28	Social Studies	6th	26	Geographic Perspectives
29	Social Studies	6th	27	Historical & Cultural Perspectives
30	Social Studies	6th	27	Historical & Cultural Perspectives
31	Social Studies	6th	27	Historical & Cultural Perspectives
32	Science	6th	15	Constructed Response (Three [3] Total Points Possible.)
33	Social Studies	6th	15	Constructed Response
34	Social Studies	7th	26	Historical & Cultural Perspective
35	Social Studies	7th	26	Geographic Perspectives
36	Social Studies	7th	26	Geographic Perspectives
37	Social Studies	7th	27	Historical & Cultural Perspectives
38	Social Studies	7th	13	Constructed Response (Two Points Possible.)
39	Social Studies	7th	14	Constructed Response (Two Points Possible.)
40	Social Studies	7th	15	Constructed Response (Three Points.)

Figure 2: Chart Illustrating Research Exam Questions by Discipline, Level of Difficulty, Standard, and Grade.

The Balloon Race alignment to the standards was validated by experts in each academic discipline. Discipline experts were identified from the University of Missouri-Kansas City by their related teaching discipline at the School of Education. They included Dr. Susan Adler for Social Studies, Dr. Cynthia Schmidt for Reading & Language Arts, Dr. Paul Rutherford for Math & Science, and Dr. Gayle Voles for Economic Education. The alignment of the intervention with 6th grade adopted standards by academic discipline is included as Appendix 2. Experts used to identify the intervention as PBL were identified by the researcher based on works published and professors currently teaching the methodology to other faculty and teachers. These included Dr. Donna Russell, Educational Technology at the University of Missouri-Kansas City, Dr. Thomas Hall, Academic Training and Dr. Hira Nair from Psychology & Education, both from Kansas City Kansas Community College.

Additional Criteria To Be Measured by Rubric in the Classroom

Two separate classroom rubrics (The Balloon Race Unit Plan, Appendix 3) were used by the researcher, teacher, and students to evaluate team and student work and to determine Balloon Race winners at the end of the intervention. These were posted in two spots in the classroom, clearly visible to all students. The first Scoring Guide for Balloon Race was used to score each Flight Log and each Flight Plan, worksheets designed to help organize teams to answer questions of destination, longitude, latitude, and what happened in history during the time of their trip through history. It included a determination of whether the entire team participated, whether all the information was accurate, whether the team was on-task, whether work was neat and, finally, whether the whole team understood all aspects of the Flight Log, Flight Plan and the artifact the team acquired on their journey and demonstrated that they could relate the events of their trip not only to history but to the

present day as well. Each Flight Log and Each Flight Plan could earn 25 points each for the team. The second scoring guide was done by each team member and used to evaluate his team and to recognize individual team member's overall contribution to the success of the journey. It asks students to grade the success of definitions and their individual group goals, their team product, and an individual team assessment. This latter questions asked team members to identify the most valuable player on the team for the trip. The total points possible for the entire unit, assuming five (5) take-offs, landings, and acceptable artifacts was 525 points. The criteria measured by the rubrics included in the intervention are based on the theories adapted from best practices and those from PBL theories, discussed in the literature review, in defining PBL, and in the alignment section outlined earlier.

Additional criteria I looked for in my classroom observations were:

- Organized and Accurate Writing Skills are demonstrated by the requirement for data accumulation for submission of the flight plan. While the flight log also requires realistic and accurate historical and map reading data, it adds the need for imaginative interpretation and intellectual freedom.
- Shared Learning is shown in three ways. First, each student is required to prepare for individual questions from the teacher; all students on a team had the responsibility to teach every other team member. Second, students shared ideas and conclusions before answering questions that earned points. Third, students that excelled in one area were expected to share their knowledge with the other members of the team.
- Use of Primary Sources when Possible was demonstrated by the research requiring students to understand and "acquire" ancient documents,

monuments, and realistic replicas. This process helped students understand the difference between the "original" and what someone has *said* about it.

- Alternative Assessments are clearly demonstrated by the Unit Plan through the use of Scoring Guides for both Flight logs and Plans, the use of a Scoring Guide that assesses the team *and* "most valued player", the requirement to place acquisition of "artifacts" in chronological order, and, finally, rewarding the first team to finish the "game" as well as the team with the most points.
- Community Involvement is demonstrated by requests and use of parental involvement in the classroom while the intervention was in progress and the use of refreshments appropriate to ancient history (i.e., brown sugar candy).
- Gardner's Multiple Intelligences Approach to teaching (1993) involved journaling for the Verbal/Linguistic; problem solving required by the Fate Cards and computing distance involved the Logical/Mathematical; pictures and models captured the attention of the Visual/Spatial; sounds and recordings played while "traveling" involved the Musical/Rhythmic; placement and movement of the balloons on the maps and the need to find sources for research kept the students moving and involved Body/Kinesthetic Intelligences; and, finally, the use of Cooperative Learning (Kalgan, 1992) with its requirements for interaction with teammates requires the use of Intra and Interpersonal Intelligences.
- Prior student knowledge is determined at the onset by the Unit Plan because students must begin the "game" by pulling together a list for survival on the balloon. Knowledge of geography and earth science can be generalized but

not attributed to individual students based on the supplies students choose to take on each trip of their journey. Knowledge of culture is important as students must "land" their balloon and negotiate their way through different cultures and share their knowledge of their own culture with their teammates. Also, students are required to provide their own ideas of how to solve problems that arise from Fate Cards and ancient history in order to compose or record what they "observe" in the Flight log. Posted Student Responses are everywhere as team post acquired "artifacts" on their team chart, their Flight logs and Flight plans, and pictures of artifacts made by students are shown in the halls and around the classroom.

- Student Ownership of Knowledge is demonstrated in the Unit Plan as students are in control of their "trip" through time. Student answers are confined only by the artifacts themselves and the ideas of their teammates. Also students control the research they wish to "find" for their Flight logs—inventions they wish to add, discussions they might have with persons from the past, etc.
- Beyond the Textbook is achieved by the Unit Plan by requiring the use of the textbook, Internet, and outside maps as resources for their research. The Flight log requires each student to go beyond the text and imagine scenes from the past.
- Interdisciplinary is met by The Unit Plan because it involves the fields of geography for map skills and locations of the ancient world and artifacts, economic ideas for development, trade and ancient inventions; mathematics

to calculate distance and speed; history for the development of civilizations, cultures and important dates; and the duplication of artifacts for "acquisition" involves artistic knowledge and talents. Additional understanding of environmental, social and survival knowledge require the use of science, math and projecting probability.

PBL approaches to the development of critical thinking are also reinforced and used frequently by familiar and traditional teaching methods. For example, critical thinking is also a goal of Kagan's (1994) cooperative learning approach. This is used extensively in the research intervention tool. Cooperative learning gives students an opportunity to discuss and to take responsibility for their own learning. According to Ennis (1996), cooperative learning encourages students to becoming critical thinkers.

Interdisciplinary teaching, always a component part of PBL, is also a traditional way of organizing curriculum. For purposes of this study, interdisciplinary is defined using the Merriam Webster dictionary as, "involving two or more academic, scientific, or artistic disciplines." As noted previously, a number of quality teaching methods can use some form of interdisciplinary theory as their base. To summarize, the accepted design for PBL is that of a complex problem with uncertain solution(s), a changing event with the possibility of diverse interpretations, and interdisciplinary or interacting social systems (Rittel, 1984). A PBL unit was used as the intervention for this research. It used the criteria outlined by Jonnassen and Land (2000) and Ennis (1996) as benchmarks.

Modifications in classroom observation time, artifacts to be acquired by students, and team assignments were made in the intervention to meet needed specifics of the study, request from the teacher, and the time available in the participating classroom from the

regularly scheduled curriculum. Beyond the theory-based grounding of the intervention, this particular unit plan was also chosen because: (a) it was an original work initially created by the researcher it could be modified easily; and (b) it appeared to improve student academic performance for the researcher's own students. Improvements seen in this earlier population of 6th grade students in one of the Kansas City Missouri urban schools included immediate student grade improvement, focused and involved learning, and significant MAP score increases two years later (an increase of 37.9 percent over previous social studies scores). Reading (with an increase of over 35%), math (with an increase of almost 15%), and science scores (with an increase of almost 7%) were also significantly higher than either the class immediately ahead and immediately behind the class exposed to The Balloon Race. This earlier observation and evaluation of The Balloon Race, however, was not a controlled study and the researcher's contact involved only half of the students in that year's class and the intervention had occurred two years earlier. Thus, any ability to attribute The Balloon Race to the Kansas City Missouri increases is not warranted.

Schedule of Research

The approval letter (November, 2009) required a shortened research schedule (Appendix 6) of five days due to mandatory MAP testing by the district and other curriculum needs. The modified timeline of the research was established as follows:

Table 2: Problem-based Research Schedule

Group	Day 1	Day 2	Day 3	Day 4	Day 5	Research	Research
		Balloon Race Begins				Conclusion/ Summary	
		Student Internet Research					
Control	Pre-test	Normal Class	Normal Class	Normal Class	Posttest		
Experimental Groups	Pre-test	Observe; Itinerary	Trips 2 & 3 of Itinerary	Trips 4 & 5 of Itinerary	Posttest		
			Interview Teacher & Students		Interview Teacher & Students	Interview Follow-up	Qualitative Coded Analysis
		Collect Student Work	Collect Student Work	Collect Student Work	Collect Student Work	Collect Student Work	Quantitative Analysis
							Compose Results
Legend							
	Tape Recorded						
	Video Taped						
	Analysis by Code						
	Statistical Analysis						

Quantitative Measures

The dependent variable for this research is the standardized test scores, established using individual student correct/incorrect answers on pre- and posttests and aggregated by research group. Test scores were compared using descriptive statistics for the cumulative total, level of difficulty, various groups, and all five disciplines. Descriptive data for race and English Language Learners were also analyzed.

The Classroom Connections to TerraNova, The Second Edition: A Resource Guide for Teachers (2002) Exam, a MAP (CBT, 2004) assessment test bank used by school districts nationally to predict annual MAP scores for reading, math and science was used to create the pre- and posttest (Appendix 5). The quantitative portion of the study includes an analysis of test scores of student demographic groups, including student background/experience, race, foreign language speakers, and economic standing from the

one control and four PBL classrooms. The quantitative variables are test questions taken directly from the Missouri Department of Education Standards for 6th grade and selected national standards adopted by discipline. The National Geographic Standards were used because the geographic expectations for The Balloon Race intervention used the state standards for 7th grade instead of 6th grade. Specific standards, including the National Geographic Standards, used for The Balloon Race intervention are detailed in Appendix 1.

Five major questions for differences between the standardized tests results of the two intervention and non-intervention groups were examined quantitatively. These were: A. Overall, was there a difference in the aggregate scores when pre-test and posttest were compared?

B. Looking at the groups separately, did those differences still remain consistent?

C. Were there differences between the groups when the level of difficulty of the questions was taken into consideration?

D. Were there differences in the standardized test scores between the groups when grade level standards were examined?

E. Were there differences in the standardized test scores between the groups when questions were separated by academic discipline?

F. Were there differences in the standardized test scores for students that were English Language Learners or minorities?

Qualitative Measures

The qualitative portion of the study was intended to add teacher and student responses from observation, survey, and interviews collected in the four classrooms. Emerging questions from qualitative data obtained from student comments, class

assignments, and observation concerning each of the teaching methods were added to the preliminary research questions after an updated review of the literature. These new issues include: (a) knowledge relevance identified by students, (b) increased understanding observed and articulated by students, (c) critical thinking demonstrating student's ability to generalize and use new knowledge, and (d) evidence of new interests in society and community. Observational data include analysis of the classroom verbal survey and student teams' time on task analysis. Increased relevance to students was measured by a survey at the end of the research (See Appendix 5), interviews with teachers and selected students (See Appendix 6) based on issues noted during classroom observation, and from student dialog during class activities. Permission forms for teachers, parents, and students are included as Appendix 8. Classroom activity was videotaped and interviews were recorded. Increased understanding applicability by students was analyzed from collected student work, selected interviews based on issues observed during class, and student dialog during and before and after class. Higher-level thinking skills were analyzed from the scored rubrics shown in the Appendix of the intervention and from the corrected answers from students on the posttest based on CTB (2002) designated level of difficulty. Increased social and community involvement was analyzed from classroom observation, the culminating classroom survey, the scored winning group rubrics, and student dialog during class. Additional measurable criteria outlining student class work for observation/evaluation are shown in Appendix 3. The preliminary research questions specifically identified for qualitative analysis were:

A. Are there differences in the types of knowledge students felt they had gained from their classroom experience?

B. Is there evidence of differences in attitudes and feelings about teaching/learning concerning community and social issues?

C. What are the teacher's beliefs regarding PBL, the teacher's role, proper classroom environment, and/or the learning capabilities of the classroom groups and the participating students?

D. Is there evidence that these beliefs impacted student behavior or achievement on the standardized test scores?

Answers to the qualitative questions were open ended. These were based on the three progressive measures outlined earlier and include (a) level of student engagement; (b) teacher beliefs about problem-based learning and student perceptions about the intervention as well as teacher and student beliefs regarding learning potential; and (c) the teacher's understanding regarding types of student prior-knowledge. These issues were documented and included in the research data primarily from the daily Interview Protocol for Teachers and supported by the Protocols for Observation and Interview Protocols for Students in Appendix 6. Data collection on current trends, customs, civil liberties, and other social and progressive issues arising during data analysis were limited because of teacher beliefs and concerns for classroom management.

Analysis of the qualitative data for student work, interviews and surveys were coded using Excel to identify any other emerging issues/questions. All of these themes were identified in the coded data and include reoccurring themes and major theories outlined in the literature review. These themes were then documented from classroom observation, teacher and student interviews, student work, and teacher comments. Themes, based on the literature review, expected to emerge from the coded data included information about (a)

teacher-led child centered instruction; (b) teacher expectations and student performance; (c) narrow/global focus of lesson plans; (d) inclusion of both low-advantaged and high-advantaged students in critical thinking; (d) implementation of non-social studies disciplines in the classroom; (e) responses to group exercises; (f) teacher's demonstration of a caring classroom environment.

Data from both qualitative and quantitative methods were collected and analyzed. Quantitative analysis using Multiple Regression of the standardized test results demonstrated differences between the research classrooms. Additionally, use of simple regression of the CTB (2002) established level of difficulty for each question was compared to incorrect individual student scores on the pre-test with matched individual corrected answers on the posttest and analyzed using a group aggregate. Further analysis was used to determine if a hierarchy of increased scores was present when academic discipline-oriented questions were compared to student's corrected scores on the posttest. Analysis of non-standardized learning and progressive issues outlined in the literature review used qualitative data from survey, interview, observation, and student work from all four 6^{th} grade experimental classrooms and the one control classroom. Result comparisons and conclusions were developed from collected data developed into descriptive statistics to create a matrix of the issues by research-identified categories. Student and teacher surveys are included as Appendix 5. The protocol for teacher and student interviews has been included as Appendix 6. The pre-/posttest has been included as Appendix 7. Additional detailed statistical and qualitative coding to determine relevant issues was also used as needed. Initially, the data was divided into subcategories, including special populations such as race and English Language Learners. Analysis of the five disciplines included in the

research intervention and standardized tests were added to the comparison between the traditional and PB classrooms. Coded data using initial themes adopted from the theories of Jonnassen and Land (2000), Lave and Wenger (1991) and Ennis (1996) and excel software was used for the qualitative analysis of emerging data. Initial research themes identified were: 1) level of student engagement; 2) teacher beliefs about PBL (and the treatment or intervention); and 3) student prior knowledge developed from the pre-test results and teacher interviews. Other themes emerged as the study progressed and these were also coded for qualitative analysis.

Level of student engagement was evaluated using observation, student interviews (Appendix 6, Student Interview Protocols), student work (Classroom Rubrics, Exhibit 3), and teacher observations (Appendix 6, Teacher Interview Protocols). Student prior knowledge was analyzed from the scored rubrics (Appendix 3, Rubrics), teacher observations obtained through interim interviews, and documented through the standardized pre-test administered and analyzed quantitatively. Teacher beliefs about PBL were evaluated using research follow-up surveys, interim interviews throughout the research process, and researcher observation, documented by video throughout the research (Table 15, Matrix Outlining Most Frequently Cited Teacher's Beliefs). Outcomes from the research was be analyzed in terms of the impact of the treatment (the intervention) on standardized test scores, relevance of learning to students obtained from student classroom interviews, student understanding, development of higher level thinking skills based on CTB categories of difficulty for each question, and increased social and community awareness confirmed by students during the classroom interviews.

Tools Needed for Research

1. Standardized Pre/Posttests

McGraw Hill (CTB, 2002) donated the materials needed to create the standardized pre-/posttest used for 61 students participating in the research. Administration of the tests followed the standard policy of the school district for standardized tests in the classroom which was to place students in rows, allow only individualized work, and a requirement that students use only a sharpened pencil and remain seated until time was called for the exam to end. Scoring of the tests were done by the researcher and reviewed by an independent educator experienced in scoring standardized tests. This was intended to assure greater validity and reliability by reducing researcher bias. The MAP and Classroom Connections to TerraNova, The Second Edition: A Resource Guide for Teachers (2002) tests is aligned with the Missouri State Standards for Education.

2. Mural-sized Geographic Map

A mural-sized, laminated wall-hanging map was donated to the participating classroom teacher. This oversized geographic map provided visual opportunity and geographic information for students to move their team balloon to various ancient locations in an effort to "pick up" artifacts and to establish a travel itinerary for their next trip and the acquisition of a new ancient artifact to geographic location and to properly orient themselves globally during the race.

3. Student Manual with Instructions for the Teacher

A student guide was prepared for each team to assist them through the various activities they needed to complete the unit. This Student Guide is included in The Balloon Race Unit Plan (Appendix 1). It also included a laminated balloon for each team.

4. Colored Pens, Scissors, Adhesive and String

General construction materials were supplied to the intervention classrooms to create their balloon, the Flight Logs, Flight Plans, and artifacts as they pick up artifacts required by the unit. The adhesive allowed teams to temporarily stick their balloon to the place and mark where they land at the end of each trip on their journeys through the ancient worlds.

CHAPTER IV

RESULTS

The research question, "Are there differences in standardized test scores when classes are taught using problem-based learning compared with the scores from traditional classroom teaching?" implies a number of related questions. The answer was never expected by the researcher to be a simple one. That is, a simple determination of identifying which group(s) in the experiment earned the highest or lowest number of points on the standardized posttest does not provide information beyond which groups scored higher; it does not offer explanations that can add to the knowledge on why some students score higher than others, what the teachers involvement should (or should not) be, or relate these differences, if found, to those issues outlined in the literature review.

The first analysis involved only whether one "group" scored higher on the posttest than the other. There were differences but Group 1 and Group 2 actually scored lower than the Control and Group 3 and Group 4 scored higher. Statistically, there was little to no difference between the groups.

However, differences involve more than just higher or lower scores and which group performed "better." CTB, the test creator from McGraw Hill (2002) designated differences in the questions on the exam instrument based on difficulty. These designations provided additional differences in the scores between the control and experimental groups. The experimental groups scored higher on the more difficult questions on the posttest.

Differences based on ESL, student ability (established by the teacher), minority status, discipline questions and answers, time on task, and student attitude were also

examined. These were minor issues (because of the size of the groups and limitations of the study) but were also seen as variables that needed further study.

While the null hypothesis for this research would be that there were no differences between the standardized test scores, the most obvious question is whether students in one type of classroom, traditional or PBL, score higher, lower, or the same as the other group. Beyond that, however, a myriad of other questions need answers to establish important information about the participating subjects, the teaching methodologies, and how and why they either work or do not work for our students. To further explain the findings, when only small differences were found in overall standardized test scores between the experimental and control groups, an examination of differences shown by corrected answers, or identifying individual student's missed questions on the pre-test and noting whether the correct answer was chosen by the same student on the posttest, between the groups was undertaken. This analysis approach documented differences between the questions designated by CTB (2001) as requiring higher-level and lower-level knowledge/skills. The purpose of this research is to begin a comprehensive examination, not of only the one difference—whether students in PBL classrooms earn higher standardized test scores than those in traditional classrooms--but also examining emerging differences such as whether the correct answers chosen might provide information that may be useful for improving education. Some of these differences may be impacting educational opportunities for minorities, low-income students, English Language Learners, and even gender dominated disciplines such as math and science. The need for the research is supported by Brock (2008), head of the New Commission on the Skills of the American Workforce along with a

host of others outlined in the literature review. As noted in chapter I, Brock (2008) emphasizes that nothing is more important than education.

This study cannot be viewed as an effort to find a quick fix for the educational system. This study is intended to set the stage for a lifetime of study on teaching methodologies and how and when they make an impact on our children. As a first study, it is limited. Its advantage is that it points to some conclusions requiring replication and additional research but with potential to change American education for the better.

As has been noted, the number (Ns) of subjects that qualified for inclusion in the study was lower than hoped. The control group had eight (8) students with fifty-three students qualified for the experimental intervention. A breakdown showing the qualification of participants was provided earlier in Table 2.

The statistical analysis broke the experimental group (N= 15; N=10; N=12, and N=16) into separate groups for analysis to increase the potential for statistical significance when compared with the control group with the understanding that using regression analysis in this research without random sampling is not generalizable to a larger population but does allow for statistical significance for smaller populations researched. For research question 1, the dependent variable was posttest scores. The independent variable was pre-test scores. For research question 2, the dependent variable was level of difficulty and the independent variable was the percentage of corrected answers on the posttest. Both an aggregate and group comparisons were separated and analyzed. Table 3 through Table 10 details these results.

The two initial questions concerning test score differences were analyzed for statistical significance where the significance tests are used, as in many other studies without

random sampling, as an aid in interpretation of the results. The first question explored any differences in total scores. The second question examined differences in test scores by the level of difficulty of each question.

Q1: Determination of Significance (Multiple Regression) from Quantitative Analysis

Two major questions of standardized test score differences required a determination of statistical significance: 1) Were there differences in overall test standardized test scores; and 2) Were there differences in scores when corrected answers on the posttest were compared by level of difficulty of the questions?

The teacher designated one classroom as the control group and the other four groups were given the Problem-based Learning (PBL) intervention treatment, The Balloon Race. The teacher used her scheduled lesson plans for the control group and was encouraged to add any concepts or facts from the intervention and teach them the way she normally taught. A multiple regression analysis was used to determine whether there were statistically significant differences between the groups being compared or whether the groups were essentially the same, the null hypothesis. Pre- and post- test scores were also compared within groups. Using a comparison of control and intervention (all four combined) classrooms collectively, there is no statistical differences ($p<.13$), between the aggregate increase/decrease in standardized test scores when comparing the control group and the intervention groups. This difference is small. Greater differences were shown when comparing the experimental groups individually. For those analyses results, a dummy variable group was added using the control group. This resulted in an R^2 of approximately 3%. While this statistical result, if not quite significant, in my opinion, is worth considering

and examining in greater detail and may be evidence for effect in one or more of the experimental groups.

The second statistical question answered was whether there are statistically significant differences between the control and intervention groups by classroom or group. While a statistical significance for the intervention general population was computed in one step, each intervention classroom was also compared individually using descriptive statistics for a more detailed analysis. The rational for using the individual experimental group comparisons instead of the aggregated intervention group was due to statistical and observed/survey/student work group differences. In explaining this decision further, the separate analysis are preferable to the analysis comparing the control (N=8) classroom versus entire intervention group (N=53) with five classrooms was used for two reasons: (a) the smaller size of each of the four intervention classrooms is a much cleaner comparison with the control; (c) separate analysis of each group also allows for comparisons between the experimental groups to analyze any differences in treatment; and (c) the division of the groups also provides opportunity for "why" questions (from qualitative data) to be more detailed.

Cumulative Results from Quantitative Analysis

The overall (aggregate) descriptive statistics for all of the groups, including the control, are as follows:

Table 3: Descriptive Statistics of Cumulative Results of Multiple Regression of Test Scores

Descriptive Statistics

	Mean	Std. Deviation	N
Posttest Score	25.08	9.622	61
Pre-test Score	19.75	8.215	61
Group 1	.25	.434	61
Group 2	.16	.373	61
Group 3	.20	.401	61
Group 4	.26	.444	61

Initially, a hierarchical multiple regression was conducted using student scores, aggregated by group, to compare pre- and posttests scores to determine whether the cumulative differences between the four experimental and control group were significant. The dependent variable was the posttest score with the pretest scores from all five classes used as predictor variables. Using the stepwise procedure, the selected model was found to be statistically significant, $F\ (1,59) = 158.402$, $P < .0001$, with the pre-test scores for all groups contributing to the overall prediction ($R^2 = .76$). Thus, there were differences between overall pre-test scores and overall posttest scores. Simply put, all groups showed progress.

A summary comparing actual scores between the experimental and control groups is shown below:

Table 4: Descriptive Statistics of Control Group Test Scores

Control group	Mean	Standard Deviation	Range of Correct Answers	N
Pre-test Score	15.875	2.475	12 - 20	8
Posttest Score	21.125	5.0832	12 - 26	
Difference	5.25	2.6082	12 - 26	

Table 5: Descriptive Statistics for Aggregate Experimental Group Test Scores

Experimental groups	Mean	Standard Deviation	Range of Correct Answers	N 53
Pre-test Score	20.23	8.635	7 - 42	
Posttest Score	25.49	10.246	7 - 49	
Difference	5.26	1.611	8 - 49	

Squared semi-partial coefficients, also known as R^2 change, represent the amount by which R^2 is reduced if a particular independent variable is removed from the regression equation. That is, squared correlation coefficients express the unique contribution of the independent variable as a proportion of the total variance of the dependent variable (Cohen, 1988). In the present study, R^2 values of each independent variable were used directly as effect size estimates and evaluated individually. According to Cohen (1988), for multiple regression models in the behavioral sciences, semi-partial R^2 values between 2% and 12.99% suggest small effect sizes, values between 13% and 25.99% indicate medium effect sizes, and values of 26% and greater suggest large effect sizes. These same criteria were used to assess whether the proportion of variance explained by the selected combination of independent variables (i.e. R^2) was suggestive of a small, medium, or large effect.

Using the aggregated experimental groups combined and comparing them with the control, only 1.5% to 3% is explained by the different treatments. This is a small effect even though the effect across groups is inconsistent. To further detail findings in individual experimental groups, individual group charts are included to demonstrate those differences. Actual differences in scores between groups are varied. When all group scores are averaged, the increase is 5.26 points. It is important to note that when each experimental group is compared to the control group, two of the groups, group 1, with only a 4.4 increase, and groups 2, with only a 1.8 increase, score less than the control group, with an increase of

5.25. Yet group 3 demonstrates an increase of 8 points while the teacher-designated "best class" scores an increase of 6.2 points. However, the significance of the performance (mean) demonstrated by the average student shows only modest increases over the control group. In fact, it provides little more than a suggestion that some students may perform better when problem-based learning is used in the classroom while others do not. Interestingly, it was not the average scores but rather the scores that were outside the regression line when statistical results were converted to a scatter plot (Illustration 2 and Illustration 3) of corrected answers and the variety of levels of performance that suggest a more robust and positive PBL conclusion might be possible when comparing level of difficulty. Scores farther away from the regression line were defined as "outliers" by the researcher. While the groups are very different in composition of populations and range of scores, by comparing the range of correct answers by level of difficulty, it is clear that the experimental group has the widest range of correct answers when the highest scores are examined (Table 11). As a result, further examination of each group was undertaken with the following results:

The Control Group

For the control group (N=8), there was a mean gain of 5.25 points for the average student with a standard deviation of 2.475 on the pre- and 5.0832 on the posttest. The control group had the lowest pre-test mean score of all the groups (15.875). Posttest means were also lowest for the control group (21.125), meaning that the opportunity for an increase in scores was enhanced by the number of correct choices (or opportunity) over the higher scoring groups. On the other hand, the number of new correct scores that were available to them limited the higher scoring experimental groups. Scores did not have the wider range of

some of the other groups with the top scores when comparing the pre- and posttest scores. Some of the ranges of the higher scoring groups began with a pre-test of 8 and topping at 42, a range of 34 points, while the control had a range of 12 to 26 points, or only 14 points. Additionally, while the standard deviation increased 2.608 from pre-test to posttest, it was extremely narrow or very small indicating that this group may have been more similar to each other. This may have limited their opportunity for more diverse learning because opportunity for differences was more limited. When actual increases in scores are computed on an individual basis, two female Caucasians scored highest.

Qualitative observations of the control group included a strong emphasis on classroom control, consistently waiting on teacher led instruction before beginning any work, control of creative endeavors by emphasizing on "getting the work done first", little or no discussion of individual ideas, worksheets used to control off-task behavior, emphasis on inquiry and teacher-knowledge rather than ideas, teacher encouragement for individual reading and turning in assignments and a general lack of student engagement. Control students did work on task when prompted. Additionally, creative efforts by students appeared to be controlled by the teacher.

Researcher observation showed that all students, exclusive of group 2, did not add color or art to assignments until the teacher gave them permission. These students, particularly the control group, typically waited on the teacher's instruction before proceeding with any assignment to make sure that they were doing what was expected. Although observation showed that some groups, such as group 1 and the control group, were more compliant than others.

Lack of engagement was observed as students participating in the study worked 5-10 minutes on definitions before their attention was diverted by the teacher to on-task individualized reading or individual off-task talking with other students about activities unrelated to the assigned task. Individual discussion or, particularly student perceptions about ideas or the subject matter did not seem to be encouraged. For example, one or two students were called on when they raised their hands in class while others were ignored. Only one question for discussion was offered during the class sessions over the course of the study. Many of the students did not complete any assignments. Some students appeared to be wandering around the class after being instructed to begin an assignment. One boy moonwalked to the pencil sharpener. The teacher ignored this student and most of the off-task behavior in the classroom as long as the room was quiet.

When the teacher did observe off-task behavior, she would caution them that she "had a worksheet for the student but they needed to complete the assignment first." This comment would be accompanied by a smile that was intended to convey that the worksheet was fun. Most of the time, students would go back to their desk without picking up the worksheet and begin reading. When students did not respond to the teacher's suggestion initially and continued the off-task behavior, the teacher would take out a worksheet, go to the student's desk, lay it on their desk, and without further instruction, point to the worksheet. The worksheets were not discussed or collected for evaluation.

One control student asked why their class was not participating in The Balloon Race and why the other classrooms were allowed to be "noisier." The teacher answered, "You are special." The noise level appeared to be a major classroom discipline issue.

Emphasis on inquiry teaching and teacher-knowledge was evident on the first day of the intervention when all groups were to go to the Library for two-by-two group Internet research. The control group was given a worksheet and not encouraged to discuss their assignment or given assigned teammates. The next day, however, they did work in groups of two for discussion of a definition but the assignment from the first day was not mentioned. The groups were asked to define several terms instead. However, rather than asking each group to report their findings, the teacher called on a couple of students she described in the interview as "more likely to have the correct answer." No other students were asked their opinions or to report to the class what they had learned from each other. She interrupted one student's verbal answer when they did not give the answer expected.

Encouraging students to engage in the lesson and to use their academic skills was defined by the teacher as individual reading from a book followed by class discussion. When a number of students raised their hands to answer questions, they were told they were "just full of knowledge" and encouraged by being told "they had learned a lot" when their answers were correct.

Comments by students in interviews indicated that they were "tired" and that "school was boring." Student perspectives, generally, were not considered. For example, on the last day of the study, several students commented, "We like to look things up." The teacher responded, "What we like the most is what we remember the best." In an after-school interview, she described her rationale for saying this as recognition of individual preferences for learning.

The control group set the bar for increasing posttest correct answers by an increase of five (5) points but had the lowest average score on the pre-test and the lowest standard

deviation of all the groups. This suggests that the participating control group students were not as intellectually diverse as the other experimental groups. This underscored the teacher's observations that these students might not be as academically advanced as some of her other classes and supported the idea that the teacher did accurately recognize academic differences. She also indicated that these students were all males and, thus, would be more likely to be off-task, particularly at the end of the school day. Also, statistically speaking, this group would be more likely to have differentiating statistical scores simply as a result of their smaller number of subjects (N=8).

Comparison of Experimental Groups

As suggested earlier, the experimental groups were also analyzed as separate groups. The purpose for doing this was: (a) any statistical comparison should consist of groups that are reasonably close in number; and (b) there were major differences in both the demographic characteristics and the treatment of the four experimental groups. Some of these differences involve issues such as student attitudes while others include things such as the PBL learning curve of the participating teacher from the first class in the morning to the last class in the afternoon.

Group 1 Analysis

Statistical results and narrative explanation of the results from group 1 are as follows:

Table 6: Group 1 Test Scores

Group 1	Mean	Standard Deviation	Range	N
Pre-test	19.667	7.594	9 - 33	15
Posttest	24.067	9.867	7 - 39	
Difference	4.4	2.273	7 - 39	

Group 1 (n=15) showed a mean gain of 4.4 with an average standard deviation increase of 2.27287. Actual overall scores ranged from a low score of 9 points on the pre-test to a loss of two points (7) on the posttest. The low scoring student on the pre-test lost six (-6) points when the posttest was scored. Increases/decreases on actual test scores ranged from -6 to +13 points with the most frequent score (4) equally divided between +22 and +23 points with the most frequent (3) posttest score +27. The high scoring student in group 1 was an African American. The Beta coefficients indicate a loss (-.003) when compared to the Control. The standard deviation for the posttest (9.867) is very close to the normal of ten (10) indicating that this group was likely to contain a typical distribution of diverse learners.

For experimental group 1 included an emphasis on teacher emphasis on high-stakes testing, low expectations, teacher-led and gatekeeping observations, development of classroom community.

The teacher saw the control group as disadvantaged because it met later in the day while group 1 was seen as advantaged because it was the first class of the day. Group 1 also had an advantage by having a longer class meeting time than the other groups. While students arrived early in the morning with many still sleepy, they had extra time for breakfast and more time to socialize before beginning their classes. The teacher commented that she planned time to allow them to wake up and used the extra time to socialize. She also planned to talk informally about more interesting topics in her efforts to engage this group of students.

Differentiated learning by the teacher was demonstrated by her concern about one student, particularly, and several others that were seen as a "slow readers." The teacher's

remedy was to have all instructions read to her only by the teacher. The teacher would then pay special attention to student understanding. Low expectations and acceptance of lower performance for these students was demonstrated by the teacher adding, "Reading would be needed prior to these students being able to function in a group setting." During my one-day teaching the classes at the request of the teacher to demonstrate how to implement the intervention, I put the team hot air balloon navigators in charge of the "slow readers'" with team directions to "Read the instructions to your teammates." I also cautioned the team that everyone on his or her team needed to be able to respond to any question I asked during the intervention. This put the students in charge of taking care of the "slow readers." The slower reading student that was of specific concern to the teacher was part of the intervention winning teams in her group. The teacher described the entire group as "not her more academically talented, but hard workers."

Development of a fledgling community spirit and cooperation was evident from observation. For example, group 1 consistently spent 5-10 minutes on task with the participating students looking to the more advanced teammates and the teacher for answers. I observed that they worked well in groups but also, when they did not think an instructor was looking, compared notes between teams. The Balloon Race rules (Appendix 3) prohibited "conferences" between teams because the teams were competitors with two steam expected to become winners in each classroom. The first to gain all their artifacts and a second team that earned the most points were expected winners. However, within team collaborative efforts were required and supported.

Strong teacher-led instruction was observed and documented by video. On the second day of travel, one of the teams in group 1 was searching the map for India. It was

suggested that the team examine latitude and longitudes. The team became engaged for about five (5) minutes. During this time, the teacher interrupted to provide additional instruction that she felt was needed. The team looking for India was back on task in less than one minute while another team went off-task. The off-task team was scolded by the teacher and asked if they were having some difficulty. The Navigator from two different groups responded to the teacher's question and said, "We don't get this because we couldn't hear you." I observed that this group, like the control group, waited for the teacher's step-by-step instruction before undertaking any assignment. In spite of the tight control, I observed them ignoring the rules of the intervention against sidebar discussions with other teams. In fact, I observed a classroom community spirit that I felt might be even more intellectually productive than the team competition environment expected by the intervention. While I did not comment on it or point it out to the teacher or to the teams involved, the observation did raise new questions for additional research in the future.

Somewhat surprisingly, rather than one team winning the intervention, three (3) group 1 teams tied for first place with seventy-five (75) points each, which included successfully acquiring three artifacts—all the identical artifacts but with differing routes to acquisition. While this was not the highest overall score for any group, it did mean that students were communicating, relating to the problem presented them, and solving the problems presented using community (classroom) resources. Group 1 winning teams in The Balloon Race scored an average of +5.33 points, bettering their aggregate group 1 score (4.4) by over one point.

On the CTB standardized pre/posttest, group 1 had the second lowest increase (4.4), higher than the lowest, Group 2, by over three (+3) points. As referenced earlier in the

methodology section, CTB questions are designed to allow for easy comparison between groups, schools, and even states based on the adopted standards for each grade level. Also, the standard deviation for this group was very close to normal (9.867) indicating the probability of a normal academic population range. Because this was the first class period of the day, the low score can reasonably be attributed to students just getting started. Also, since the teacher had expressed uncertainty about her ability to teach the intervention, the later groups may have had more of an advantage simply because the teacher had more time to practice the lesson presentation. Thus, teacher familiarity/education may have been a factor in the lower scores for group 1.

Group 2 Analysis

Statistical results and narrative explanation of the results from group 2 are as follows:

Table 7: Group 2 Test Scores

Group 2	Mean	Standard Deviation	Range	N
Pre-test	23.0	8.932	6 - 35	10
Posttest	24.8	11.802	7 - 42	
Difference	1.8	2.87	6 - 42	

Group 2 (N=10) had a mean gain of only 1.8 points while the control group had a mean gain of 5.25 and the aggregate experimental group had a mean gain of 5.26. While this low increase might be explained by comparing group 2 pre-test scores (20.23) and posttest scores (25.49) with the lower control group pre-test (15.875) and posttest score (21.125), this does not seem to fully explain group 2's small increase when compared to all the other groups. Group 2 had a standard deviation increase of 2.871. This is an unexpected low increase and can be at least partially explained from observations obtained during the

qualitative portion of the study. Increases/decreases ranged from 0 to +12 with over eight (8) of the ten students increasing their posttest scores by less than three (3) points. Group 2 also had a negative beta coefficient (-.065), the lowest beta for all of the groups. Standardized coefficients (or beta coefficients) are the statistical estimates resulting from an analysis of standardized variables so that their total (aggregate) value is one (1). Typically, this is done to answer which of the independent variables have a greater effect on the dependent variable in a multiple regression analysis, when the variables are measured in different units of measurement. In this instance, for example, it can be used as a measurement of the percentage of corrected answers from the student pre-test/posttest scores and level of difficulty, measured by group. It provides a hierarchical comparison that establishes which of the independent variables have the greater effect. Compared to the control group, students in this group showed a decrease in posttest scores after controlling for the relation between pre- and posttest scores. Interestingly there was only one score of forty-two (42) points on the posttest with the one increase of twelve (12) points over the pre-test score that could be seen as an outlier this group. The lack of score diversity might suggest collaboration or cheating on the exam(s). The posttest standard deviation (11.802) indicates a slightly higher level of differences in the group population and suggests that further study and observation are needed. Caucasians, the minority in group 2, had both posttest high scores.

Compared with the other three experimental groups, I found group 2 to be the most challenging. There were two reasons for this: first, this group was the only experimental group that scored lower than the control group for almost all aspects of the study. Second,

they had a collaborative community that was clearly observable both in the classroom and in the hallways between classes.

Teacher expectations and analysis of the group was described as "intelligent but talkative." Later she commented that they had "some difficulty staying on task and would use questions and other acceptable classroom activities to divert the attention from any planned lesson." This reinforced my observation that it was, perhaps, a group effort. My observations and comments from students in the class suggested that they did not wish to be stereotyped, particularly by standardized tests that had no impact on their personal transcript. Additionally, observation and the video showed that they paid little heed to instructions and tended to be motivated more by individual goals. Because of this observation I wondered if, given less emphasis on classroom management and more emphasis on individualized, child-centered learning (Applebee, 2007), this classroom had more potential for higher-levels of learning than was acknowledged. My concern with this group was that their potential was being artificially limited both by an excessive management style and students' inability to set acceptable success goals based on what was expected (and, in some cases, documented by standardized tests) for them. The concern that they were limiting their performance was re-enforced because of the documented increased time on task when compared to the other groups. Generally, engagement by students in the experimental groups was longer than engagement on-task by the control group. For group 2, however, an average of 15 minutes was normal but could, for some teams, could last as long as thirty-minutes (30 minutes) or more depending on the topic and the team's ability to move away from the lesson plan and individualize learning using both collaboration and by dividing up the component tasks required to complete the assignment. I observed that it

took less time for groups to answer questions in group 2 than in the other classes also. Between team conferences (sidebars) were frequent but did not take on the community aspect observed in group 1. Unlike group 1, group 2 recognized the competitiveness of the intervention and set goals to win the race but they collaborated with other teams when it was in their interest to do so.

Group 2 consisted of twenty-seven (27) students with only eleven (11) having signed consent forms from their parents. The school had wanted to take over the responsibility of getting consent forms signed by parents in spite of the fact that I had suggested that I could contact parents individually. Unlike the other classes, where non-participating students had few teacher-made comments beside a student's name by the teacher to follow up if students did not turn in a consent form; this class had the comment, "Not Signing," noted beside the names of six (6) students that I had been told were contacted personally by the teacher. When the teacher was asked about the comment she said, "Some parents just refused to sign." After class on the third day, I approached one student in the hall before class and asked why her parents had not signed. She replied that her "parents had not signed because her mother was under the impression that the researcher—an outsider—would be looking at student's private files." I explained that I did not need her private files for this study.

As noted earlier, this group, unlike the other groups, did not wait for instructions from the teacher prior to undertaking tasks. Once they were told they could read the instructions to their classmates, work as a group, and had the responsibility for producing a product such as the drawing for the artifact they acquired during The Balloon Race, they participated but with little enthusiasm.

Unlike group 1, there was only one winning team in group 2. This group gained an additional 10 points (for a total of 85) because they added color to their picture (without asking permission). They had not been told they could add color but the directions had included the fact that color would add extra credit. The colored markers were available in the classroom, they knew where to find them, and they had no hesitation about classroom expectations or norms if it meant they could define their own learning for a few minutes, a day, or during the five-day intervention!

While exceeding expectations for their own benefit, they did not become noisy or disruptive. They commented that they did not want to attract discipline from the teacher! This community spirit generated may have manifested itself in quiet mass rebellion both for and against anything different. I observed them collaborating on assignments and they told me that the exams had no benefit for them since they would not be added to their grades for the semester or placed on their permanent records. Group 2 was the only group to ask whether the scores would be recorded.

The emphasis on individualized and creative education by many of these group 2 students was again emphasized during the exit classroom interview by an exchange with one student. He commented, The Balloon Race was, "Fun…but confusing…and difficult". He added, "It was boring and slow and I never want to do it again." When I pressed him further to find out what, if anything, he had learned, he said, "I learned how to pick up a pyramid with a hot air balloon." The class broke into laughter. Students had been told to "pick up their artifacts by drawing a picture of the artifact." While another teammate had drawn their team picture of the pyramid, he was trying to determine how a pyramid might actually be picked up and transported. This was the higher-level and individualized thinking that PBL

is designed to create. The young man pulled out his calculator and began estimating the weight of the pyramid and whether the hot air balloon could lift a pyramid. Then the student complained that "the directions were too difficult" and that he "had to do too much writing." I asked him what he needed to know in order to lift the pyramid. He responded, "How much the pyramid weighed" and "how much weight a hot air balloon could lift." The information he needed was on the Internet (the weight of a pyramid block) and already given to him in the directions for take-off. I asked him, "How many balloons would it take?" He provided the answer the next day.

The overall scores for this group resulted in the lowest increase of any of the groups in the study (only 1.8 points). This is almost four (4) points lower than the control group. Several students in this group complained that they had just taken the MAP tests and that they were "tired of all the tests." I suspected that a number of students chose not to try very hard or do their best on either the pre-test or the posttest after they were told that it would not impact their grades. Interestingly, none of the other groups asked how the research exams might impact their grade. The Balloon Race winners increased their average points to 4.67. This was almost the average 5-point increase of the general research population!

Group 3 Analysis

Statistical results and narrative explanation of the results from group 3 are as follows:

Table 8: Group 3 Test Scores

Group 3	Mean	Standard Deviation	Range	N 12
Pre-test	17.167	7.120	7 - 30	
Posttest	25.167	9.843	12 - 42	
Difference	8.0	2.723	7 - 42	

Group 3 (N=12) showed a mean gain of eight (+8) points for the average student with a standard deviation increase of 2.723. Actual increases/decreases ranged from -1 to +21 points. Three of the higher scoring students were Caucasians and the fourth was an ELL Hispanic student. Again, like group 2, no score or set of scores was shown to be more frequent than any other for this group. Beta coefficients showed an increase of 1.5 over the control group. This represents the most increase on the posttest scores after controlling for the relation between pre- and posttests scores. Major variables/issues that were seen as explanatory reasons for the overall text score differences by this group included teacher expectations, use of play, and learning enhancement.

Group 3 demonstrated the greatest increase (8.0 points) in pre/posttest scores of all the groups (with the winning classroom team increasing their average by 9.2 points). These "best scores" were correlated with the most time on task, an average observed time of 15 – 20 minutes before breaking concentration. They had two groups that tied as Balloon Race winners with seventy-five points (three trips).

Teacher comments about her expectations for the group indicated that this class was her "second best" class of the day and "that these students were smart as well as motivated." The standard deviation for this group indicates that they are normally divided (9.843) and would suggest a typical academic population. Since this was the third class of the day, the teacher had time to practice the lesson plan before presentation to the class so fewer interruptions and confusion would have been expected.

Group 3 did become more and more noisy as time for the race to end. The end of the race provided incentives for students to work faster, try harder, and created anxiety if they were behind. But each team wanted to win the race. In students' haste to win, the oversize

geographic map fell from the wall. Students were concerned that they would not be able to get their work completed before the intervention ended. They were not concerned about the teacher's frown and continued in their somewhat chaotic but motivated goals to win. I instructed the students to clear the desks away from the middle of the floor and put the map on the floor. The process took less than a minute and the class was able to continue without further disruption. The students said they enjoyed being able to form team groups on the floor beside the map in the middle of the chaos instead of having to work at their desks.

Learning enhancement was documented during the taped exit interview by comments that students have observed that much of the intervention "covered areas they had not covered in class." They said they enjoyed the challenge and pointed out that new knowledge included figuring distance, determining weight, and use of creative thinking. They also commented that they liked the increased amount of writing that they were required to do with the Flight Log. Some students indicated that, for the first time, they had to develop a strategy (travel itinerary) and that this caused them to have to think harder than normal for social studies. They asked if they couldn't "just continue the race" tomorrow and were disappointed when I told them we would have to stop to take another exam tomorrow.

Group 3 was observed as more playful that the other groups and showed their enjoyment easily. Several students were also observed taking liberties with the research video camera for short periods of time (less than thirty seconds) before placing it back in its place on the desk. They also did not answer or turn in the definition questions prepared for them by the teacher at the start of class or wait for the teacher to tell them "what the answer was." Several of these students had to start over because they did not read the instructions before beginning the intervention. Yet, they outperformed their other peers and were

observed to be able to move through the assignments quickly in order to make up lost time. Group 3's inquisitiveness and apparent acceptance of individual risk-taking in an academic setting may help explain their better performance. However, while observed, conclusions that they were more willing to take chances than, for example, group 2, would take more study.

Group 4 Analysis

Statistical results and narrative explanation of the results from group 4 are as follows:

Table 9: Group 4 Test Scores

Group 4	Mean	Standard Deviation	Range	N 16
Pre-test	21.313	10.268	8 - 42	
Posttest	27.5	10.570	14 - 46	
Difference	6.187	.302	8 - 46	

Hour 4 (N=16) showed a mean gain for the average student of +6.187 points with a standard deviation increase of .302. The standard deviations for both the pre-test and the posttest were in the normal range indicating that the group population had normal differences. Individual student increases/decreased ranged from -2 to +21. The high score (46) and five other scores above the 10% average were earned by one African American student and four Hispanic students. The pre-test had a high frequency (4) of +20 points while the there were equal frequencies (2) each in scores of +14, +16, and +27 for this group. The beta coefficients (.077) for this group, with 1 seen as the statistical norm, indicate a small increase when compared to the control group.

Variables or issues that were documented through qualitative measures for group 4 included teacher expectations, student interest/engagement, and the interdisciplinary/holistic

approach. Teacher expectations for group 4 were high. The group was described by the teacher as her "best and most intelligent" class in spite of the fact that they scored lower than group 4. They were observed as both well behaved and attentive. The group scored well on both the pre- and posttests and had the highest winning score (200 points or over two full trips) for The Balloon Race. Students had the potential to score a maximum of 525 points over the four days of the intervention. However, the winning team's posttest scores demonstrated only a 3.5-point increase. This was probably due to the fact that one of the team members did not have both a pre-test and posttest and so could not have their scores included in the calculations.

Students were instructed to pick up artifacts chronologically, which would allow them to "travel" to several different countries. High scoring students picked up artifacts only from Egypt, which was the only country they had covered during the first semester. In many cases, the artifacts were not picked up according to the intervention rules.

The average increase on the pre/posttest for this group was over six (+6) points or not quite one point higher than the control group. They had a normal standard deviation (10.5), suggesting a normal population distribution. The group came in as the second highest increase, scoring not quite two (2) points less than group 3. This group consistently used their time well with observed averages on task of 15-20 minutes. Time on task improved greatly and extended to 30 minutes or more on the last day of the intervention.

This group demonstrated interdisciplinary learning and learning enhancement also. The group expressed support in the form of comments to each other and the teacher for having been challenged with test questions "…outside of social studies." They demonstrated their enthusiasm for The Balloon Race by asking if they could not have

"…more time to finish it." Group 4 was lively but not overly noisy. The noise and discussion was on-task and directly related to the lesson and they complied readily with the teacher's management style.

Both the chart of student and teacher's beliefs in Tables 16 and 17 and the more detailed discussion that follows further supports the qualitative explanatory data.

Future research is needed because of the nature of the scores not represented by the regression line (also called outliers), which according to Miles and Huberman (1994) can be used to further support qualitative research findings. Additionally, the differences between groups 3 and 4 suggest that the small differences between PBL and traditional teaching methods using regression statistical analysis may not measure or explain the differences outlined above.

Q2: Differences in Group Scores Based on Level of Difficulty of Questions

General differences for all groups combined as an aggregate on the forty (40) question exam, the n for this analysis, showed a mean increase of +1.2958 (S.D. of .48735) in correct answers on the posttest while the average mean for level of difficulty established by CTB for all groups was + 14.15 (S. D. of 8.176). The aggregated descriptive statistics for level of difficulty for all groups is shown as follows:

Table 10: Aggregate Descriptive Statistics Comparing Mean Level of Difficulty with Percentage of Correct Answers

Group	Mean	Standard Deviation	N
% of Pre/Posttest Correct Answers	1.2958	.48739	40 (Questions)
CTB Assigned Level of Difficulty	14.15	8.176	40 (Questions)

This aggregate analysis used the experimental group percentage of pre- and posttest correct answers as the dependent variable and the CTB assigned level of difficulty as the

independent variable. The percent represents the percentage of gain or loss of all students from pre- to post test on each specific test item. Table 11 details the level of difficulty scores earned by individual groups. Higher scores at the higher levels of difficulty (above 12 and increasing in difficulty) were shown (42-54% increases in correct answers) for the experimental groups and less than 34% for the control group.

A new and separate regression analysis was used to determine whether there were statistically significant differences between the groups (n=5) being compared or whether the groups were essentially the same, the null hypothesis, when the level of difficulty of the questions was analyzed. The data was reformatted to examine each question by the CTB designed level of difficulty. The lower levels, or those that require basic skills and memorization according to CTB (Levels 1 – 12) were compared with the CTB designated higher difficulty levels (13 – 27) by aggregate groups and within groups to determine if there was any differences in the difficulty level shown between the groups. The dependent variable for this analysis was total percentage for level of difficulty for levels 13 -27. CTB designated levels 1 -12 were the independent variables with regression analysis for each experimental group calculated independently. The control group was calculated as a dummy group.

Using not only a comparison of control and intervention classrooms collectively but also separately analyzing control and classroom-by-classroom comparisons, there are statistically significant differences ($p<.05$), between the correct answers by level of difficulty in the standardized test scores when comparing the control group and the intervention groups. However, these differences are also small.

While statistical significance for the intervention general population was computed as an aggregate, each intervention group was also compared to the control individually using descriptive statistics for more detail. Like the Q1 comparison above, using individual intervention comparisons instead of the intervention group aggregate helps to offset uneven subject participation and observed group differences that are measured qualitatively.

A regression was conducted using exam questions and comparing student scores, aggregated by group, to compare pre- and posttests answers for each question to determine whether the cumulative differences between the four experimental and the control group were significant. The dependent variable was the was the experimental group percentage of pre-test and posttest correct answers with the experimental group aggregated percentage on the pretest scores used as predictor variables. The selected model was found to be statistically significant, $F(1, 3.606)$, $P < .05$, with the pre-test scores for all groups contributing to 24% of the overall prediction. According to Cohen's criteria, this is a medium effect.

To illustrate these differences, two scatter plots show level of difficulty for the control and experimental groups show the trend for higher scores at lower levels for the control and increasing higher scores for the experimental groups. Again, the difference between the number of subjects (n's) participating will influence the trend line but does not negate the overall effect. Table 11, detailing level of difficulty data by group, used the same database as the scatterplots. The high number of scores earned by the experimental group at levels above the lower CTB designation of 12 indicate to the researcher that more research is needed. Figure 3 illustrates the Control group's posttest answers according to level of difficulty:

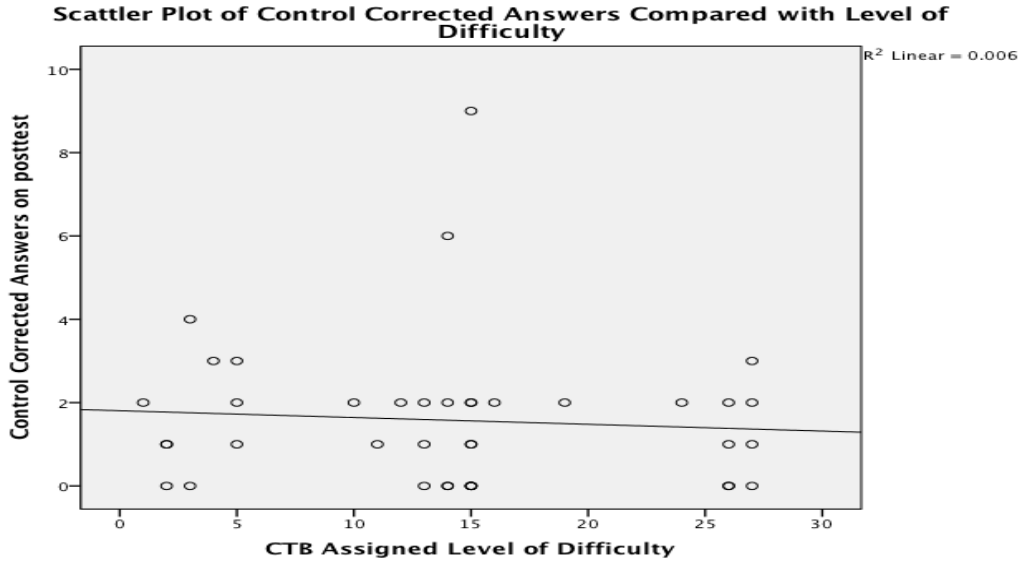


Figure 3: Scatter plot Regression Line Demonstrating Corrected Answers and Level of Difficulty for Control Group

Figure 4 illustrates the difference on level of difficulty between the posttest corrected answers regression line from the control group and that of the scores by the experimental group:

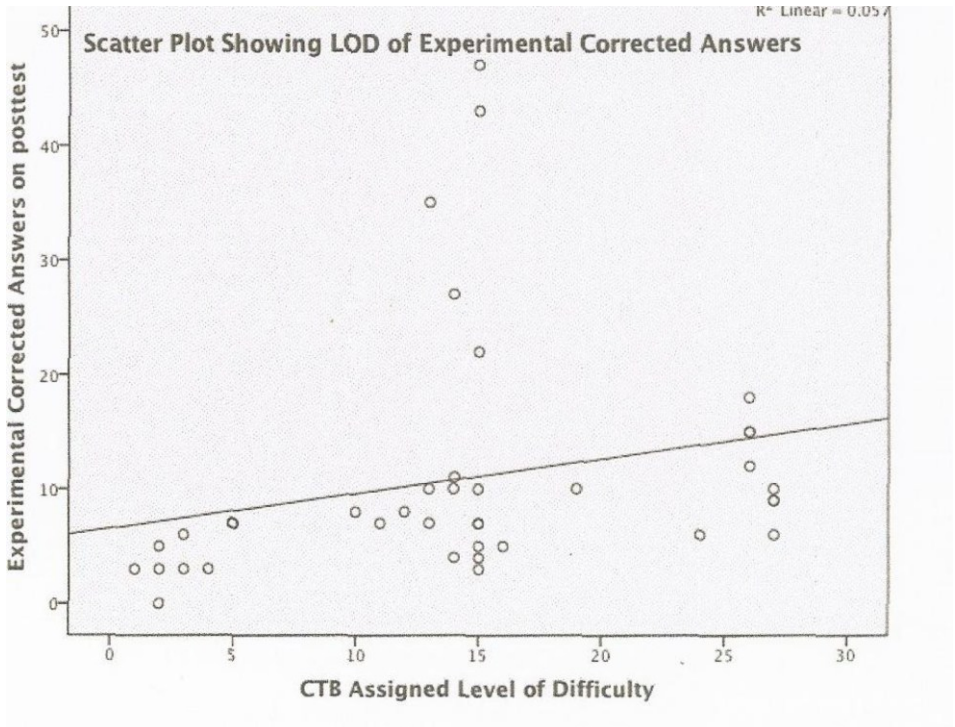


Figure 4: Scatter plot Regression Line Demonstrating Corrected Answers and Level of Difficulty for Experimental groups

The two scatter plot charts comparing the correct answers of the control and experimental groups demonstrate higher levels of difficulty achieved on the posttest by the experimental groups and increased lower levels of difficulty achieved by the control group. As a result, it can be concluded that the two groups differed in their ability to answer higher- and lower-level questions after the intervention.

The number of or individual scores that were more than 10 points higher than the regression line (outliers), shown by some of the groups, was the catalyst for researcher interest. While there were no outliers when comparing the differences between the experimental and control groups' standardized overall test scores, there were an unusual number of outliers when scores were compared by level of difficulty on the questions themselves and is the basis for the second major question examined by multiple regression. Students with scores that were outliers were observed, interviewed, and the teacher was questioned about the student's academic potential. She expressed her belief that most, but not all, of these students were academically advantaged. The control group had outliers of +10 and +11 while the most frequent score on the pre-test (2 students) for this group was +15 and the most frequent score (2 students) on the posttest was +26. This, compared with the outliers for some of the experimental groups with an increase of up to +29 points was higher and with more frequent higher scores when compared to the control group. Outliers for group 1 included one student who increased their score by +13. Group 2 outliers showed both an increase in overall points (+12). Group 3 outlier scores included two students who increased their posttest scores by +10, one +12, and one +21. Outliers for group 4 included individual student increases in scores by +10, +11, +13, and one +21. The outliers in the quantitative results seen in Figures 2 and 3 provide stronger implications than the initial

statistics of standardized test score differences in spite of the fact that the quantitative analysis demonstrate statistically significant indicators of high-level thinking development by the experimental groups. Miles and Huberman (1994), qualitative researchers, indicate that any finding invariably has exceptions and that ignoring them can create a loss of supporting data that can "test and strengthen the basic finding" (p. 269).

Additionally, higher levels of difficulty were attempted more frequently by the experimental groups and their frequency of correct answers were higher above Level 12 of difficulty, excluding Levels 16 and 19 (6th grade Algebraic function and 6th grade science inquiry). The experimental groups answered levels 13 – 27 not only more frequently, but they received more correct results at that level. Conversely, higher correct answers were shown by the control group for questions designated by CTB as those requiring lower levels of difficulty, basic skills and memorization. Table 11 demonstrates these differences:

Table 11: Differences Showing Posttest Level of Difficulty by Group

Designated Level of Difficulty	Group 1 % Corrected Answers	Group 2 % Corrected Answers	Group 3 % Corrected Answers	Group 4 % Corrected Answers	Control % Corrected Answers
1	4	6	0	7	18
2	8	8	6	5	10
3	30	25	20	67	100
4	0	100	33	0	60
5	45	17	26	14	75
10	10	50	17	25	50
11	63	11	11	0	20
Lower Levels	22.8%	31%	16.1%	16.9%	47.8%
12	100	67	20	33	50
13	61	19	58	41	14
14	32	20	41	24	50
15	54	77	50	84	47
16	25	33	20	33	0
19	100	0	29	27	25
24	10	0	40	30	67
26	67	16	100	57	20
27	38	54	33	50	31
Higher Levels %	54.1%	31.8%	43.4%	42.1%	33.8%

The chart compares the number of incorrect answers by each student on the pre-test to the same questions answered correctly on their posttest and converting these raw scores into an aggregate group percentile for each question on the test. Each question is then matched to the designated level of difficulty specified by CTB with the difficulty levels for higher and lower levels divided at level 12. The chart shows that group 1 had over 54% of its posttest corrected answers above level 12 with not quite 23% below; group 2 scores were almost equally divided between lower level and higher level question (approximately 31%); group 3 scores (over 43%) at the higher levels with only 16% at the lower levels; and group 4 scores were similar to Group 3 with 42% of the corrected posttest answers at the higher levels and over 16% at the lower levels. The control group scores were slightly higher than experimental group 2 with not quite 34% scoring in the higher levels and almost 48% scoring at the lower levels of difficulty.

Q3: Examination of Grade Level Posttest Answers

An analysis of correct answers by questions according to adopted standards by grade level shows that the Experimental groups were able to answer questions at the higher-grade levels.

The following table demonstrates the comparison of grade level scores by group:

Table 12: Differences Showing Posttest Results by Grade Level

Group	N	Corrected Answers for Grade 5	Corrected Answers for Grade 6	Corrected Answers for Grade 7
One	15	101	163	50
Two	10	70	154	14
Three	12	80	129	1
Four	16	104	206	39
Total	53	355	652	104
N Average		6.7%	12.3%	1.96%
Control Group	8	50	79	4
N Average		6.25%	9.88%	0.5%

Scores for academic performance at the 5th grade level are almost identical while scores for the experimental group moves ahead for 6th grade standards mastered. There does appear to be a more significant change for the questions based on 7th grade standards. Since all groups were 6th graders, the 7th grade skill difference by the experimental group may be partially attributed to the intervention. Another explanation for the higher score for the experimental groups may be that the larger number of students in the experimental groups when compared to the control group and the more diverse levels of ability. As noted earlier, the pre-test scores and standard deviations of a number of students in the experimental group suggest that the experimental groups began with more prior knowledge than did the control group.

Q4: Descriptive Statistics of Winners of the Balloon Race

There were thirteen (13) students that earned high points and became designated "winners" of The Balloon Race. The question being asked here is whether these winning students score significantly higher, lower or the same as their classmates on the standardized test measures? A chart showing these results is as follows:

Table 13: Chart Demonstrating Posttest Results from Intervention Balloon Race Winners

Group	Total Winning Points	Total Raw Pre-test Scores	Total Raw Posttest Scores
Group One	75 out of 375 possible	67	83
Average % Increase Average Score Increase			24% 5.33 points
Group Two	85 out of 375 possible	92	106
Average % Increase Average Score Increase			15% 4.67 points
Group 3	75 out of 375 possible	89	135
Average % Increase Average Score Increase			52% 9.2 points
Group 4	200 out of 375 points possible	56	63
Average % Increase Average Score Increase			12% 3.5 points

The statistical significance of this observation is suspect because of the small number of students that won (N=6) and also because not all of the students on winning teams had signed permission forms or were present for both the pre- and post tests. As a result, their data could not be included in the research data. As a result, important pre- and post test scores are not included in these results. In spite of this, the experimental groups performed generally the same as their non-winning peers. With an average aggregate score increase of +5 points, group 3, with an increase of over nine (9) points, was the only experimental group winning team to outperform all the other teams. Comparing the within groups, however, both groups 1 and 2 earned higher scores than the aggregate team average. Group 2 was the only group that used color on their artifacts and received 10 points "extra" for their artwork.

The differences shown by experimental group 1 winning teams (3) in The Balloon Race scored an average of +5.33 points, outperforming the other participating group 1students by over one point. Interestingly, while group 1 had a three-way tie for winner of the intervention (75 total points each), the winning team in group 2, on the other hand, won by adding color to their artifact picture (for a total of 85 points). Group 2 Balloon Race winners increased their average points to +4.67. This was almost the average five-point (+5) increase over their average group 2 score. Group 3 Balloon Race winners only increased their group scores on the posttest by +1.2 points but they had the largest group increase (+9.2) in pre/posttest scores of all the groups, more than double their groups 3 aggregate score. Group 3 had two groups that tied as Balloon Race winners with seventy-five points (three trips) each. Group 4 scored well on both the pre- and posttests and had the highest winning score (200 points or over two full trips) for The Balloon Race. However, winning team posttest scores demonstrated only a 3.5-point increase over their total group average

increase. This may have been due to the fact that one of the winning team members did not have both a pre-test and posttest and so could not have their score included in the calculation.

Interestingly, while both experimental group 3 and group 4 scored considerably higher than the other groups, including the other experimental groups, on the posttest; only the group 3 winning team doubled the average score increase of their group. Group 4 intervention winners did not match the increases of either experimental group 1 or group 2.

Q5: Examination of Academic Disciplines

In 2001, the United States adopted the No Child Left Behind (NCLB, 2001) legislation establishing goals of increasing certain academic disciplines determined to be needed in our public schools. NCLB places greater importance on some subjects than on others establishing a sort of hierarchy of value. This hierarchy emphasizes improvement for math as the first goal, Language Arts as the second most important goal, science as the third while social studies was not included as a major focus (Popham, 2001). The frequency of correct answers by academic discipline in this research supported this general hierarchy of adopted policies of NCLB (2001). The following Table shows the hierarchy of corrected answers for all groups in the study:

Table14: Frequency of Correct Posttest Answers by Academic Discipline

Group	N	Reading/ Language Arts	Math	Life Science	Science	Physical Science	Total Science	Social Studies
One	15	95	63	3	24	36	60	89
Two	10	78	57	5	24	19	43	49
Three	12	88	54	5	23	22	45	27
Four	16	105	88	5	30	27	57	88
Total	53	366	262	18	101	104	205	253
Average		91.5	65.5	4.5	25.3	26	51.25	63.25
Control	8	41	36	4	17	14	31	20

Clearly, the results indicate that students performed according to the NCLB priorities under the current education legislation.

Variables related to improving standardized test scores/academic achievement by discipline according to the literature are interdisciplinary and holistic teaching approaches, multiple intelligences when it is directly associated with a specific discipline, emotional and intellectual safety to speak out in the classroom, the creation of explanation rather than the right answer environment, the teacher's belief regarding inquiry-oriented learning, and classroom lessons that build on prior knowledge.

When these qualitative issues are compared to the quantitative results, a more grounded perspective results and it is possible to determine some reasonable conclusions from the statistical data beyond a general hierarchy of discipline emphasis. Differences are shown to exist when the groups are compared by discipline when examining Table 14. For example, the greatest per student increase in reading and language arts (7.8%) was made by group 2. This was the group where the teacher had concerns about the students' abilities to

read and follow instructions without having them read and explained to them. While this gain might be partially explained because of low pre-test scores, it also shows that, without the teacher's reading intervention, students were able to increase their scores after the intervention. The control group, with similar pre-test scores, had only a 5.1% per student increase. Group 2 (5.7% increase) with group 4 (5.5%) close behind, demonstrated the highest increase in per student math scores. Total science scores also demonstrated the ability of group 2 (4.3%) to increase average per student scores on the standardized test while group 1 demonstrated the highest increase (5.9%) in social studies. Group 4 increased their per student scores by 5.5% while group 2 only increased by 4.9%. Group 3, only increased by 2.3% with the control group increasing per student scores by 2.5%.

By combining the results on Table 14 with the qualitative student observations and interviews in Table 17, the data does provide a few suggestions regarding student achievement. For example, over 29% (15 students) in the experimental groups recognized that they were being exposed to more than social studies by the intervention. 0ver 69% (35 students) indicated in the post study interview that they felt they had learned more than was typical in the week of the intervention. Some students modified their response by indicating that they had learned more about one discipline, less about another, and about the same for a different discipline. Since the intervention standardized test and intervention did not equally emphasize all disciplines, the student perspective on what they felt they learned is important simply because they may have learned more in their prior school about some disciplines than others. It is clear from the quantitative results, however, that the intervention standardized test scores in every discipline were higher on average than the control group.

Earlier observations about established community and networks may also play a role here. In examining the per student increases, it is also possible that the group 2 interaction played a pivotal role in their ability to increase disciplinary scores. Additionally, group 2's creative and general willingness to move outside of the teacher's classroom management style may have also benefitted group 2.

The lower scores by the control group in every discipline appears to point to the fact that traditional classroom teaching may not provide as much of an advantage for any of the academic disciplines as PBL. However, a regression analysis was not done to determine significance due to the low Ns in all the groups and the fact that differences, while present, are similar to the cumulative increase in standardized test comparison. These results are similar to the studies mentioned in the literature review that suggest that interdisciplinary teaching approaches, by themselves, may not provide a significant increase in academic achievement. More study is needed.

Q6: Examination of Results Comparing English Language Learners and Minority Responses

The scores, aggregated by group also follow the same general pattern as the group scores noted for the groups, cumulatively, above. The descriptive statistics for these groups are as follows:

Table 15: Descriptive Results of Exam Scores for Non-White Students

Test	Group 1 (N=7)	Group 2 (N=4)	Group 3 (N=6)	Group 4 (N=6)	Control (N=4)
Pre-test Score	18.1	16.8	14.33	19.67	17.0
Posttest Score	22.1	18.0	21.0	28.17	21.0
Difference	4.0	1.2	6.67	8.5	4.0

Regressions for differences shown in the pre- and posttest scores for all English Language Learners [F (1,3) = 19.871, P< .05] research participants and a separate analysis for non-white student participants [F 1,21) =10.847, P < .0001] revealed only preliminary results due to the small number of subjects. English Language Learners in both the Control and Experimental groups scored exactly the same increase in points (+6) from pre- to post test. Means for these groups do not demonstrate any important differences due to the low number of participants.

Since the average increase for all the groups reported earlier was approximately a four-point (+4) increase in scores, the increase of experimental group 2 (+1.2) is the lowest of all the groups. The performance of experimental group 1 and the control group (+4) is identical. Yet, experimental group 4 (+8.5) and group 3 (+6.67) stand out as statistically different. While the traditional quantitative statistician might conclude that there is little point in further analysis, this is a "why?" question for which mixed method research is designed to help answer. While we have already determined that the results of this research only applies to this group of participants, it can also be suggested that the research needs to be replicated to improve what we already know and understand about PBL. Moreover, new and more detailed analysis needs to be completed by adding new questions including why there are large differences in the results, looking particularly at the outliers, when groups are compared. Was it differences in the group populations, differences in the treatment, differences in attitudes of either the students or the teachers, or something else? Beyond these "why?" questions also looms questions of what needs to be changed in follow-up studies.

Does race or English as a Second Language make a difference? Groups by race and English Language Learner (including ESL) designations did not show any differences. Table 14 showing the descriptive statistics is included above. No qualitative observations, survey, or interview data suggested any new information for these groups. This data can also not be generalized to other schools or organizations because of the small number of students involved. On the other hand, differences in posttest scores of those students winning The Balloon Race, particularly those that scored 200 points out of the 375 possible, did show important advances, particularly for Hispanic and ESL students.

Multicultural foci included the fact that the intervention, ignoring some of the teacher's concern about controversial issues, did include drawing the Rosetta Stone that explains how the Egyptian language was finally able to be understood, finding the first large cache of African gold, examining economic markets such as the silk trade in China, and drawing and understanding Islam's holiest shrine. Two students were overheard discussing community issues including the slow economy (unemployment) and the World Trade Center as they identified with these issues. Also, it was observed and reinforced by the teacher's comments that students were treated with affection. I observed two or three gentle hugs per day, particularly to minority and ESL students and comments such as, "I like you" were frequently given. This type of encouragement was observed to be directed more at the minority and ESL students. Also evident was low expectations and an unwillingness to allow them to make mistakes. The teacher felt that this would "confuse other students" and "embarrass the student."

Q7: Examination of Results Shown by Student Engagement

For purposes of this research, student engagement was defined as "interest" for

students, "student engagement" when the teacher's perception was being analyzed, and "time on task" for purposes of research observation and to compare groups statistically for classroom focus on the lessons. This latter designation of timed engagement with the subject matter is one of the most frequently cited examples of student engagement in an observation on student time on task. To obtain this designation, the researcher timed students in their teams in all classrooms for the three days of the intervention and in the regular classroom. When students lost focus, changed the subject, or appeared restless, the researcher stopped timing and recorded the total amount of time "on task." The following amount of group time on-task was as follows:

Table 16: Chart Showing Time on Task by Group

Group	Observed Time on Task without Interest Loss	Increase in Test Scores
1	5 – 10 Minutes	4.4 Points
2	0 – 18 Minutes; One Team not participating	1.8 Points
3	10 – 15 Minutes	8 Points
4	15 – 20 Minutes	6.2 Points
Control	5 – 10 Minutes	5.2 Points

Increased scores on the posttests for each of the four experimental groups and the control classroom have been included on Table 15 for comparison. Table 15 shows that the two groups with the longest recorded time on task were also the groups that earned the highest increase in scores on the posttest.

Time on task was also observed, as was respect shown in the classroom, challenge, opportunities for creativity, and an emotionally and intellectually safe environment in which to test ideas. Observations and interviews with the teacher and students showed this classroom to be more traditional, using some PBL components but emphasizing basic learning. This was reinforced by teacher interview and classroom comments. Respect for students was obvious and was articulated. Genuine affection was shown by both the teacher

and the students for each other. However, because of the teacher's emphasis on tight classroom control, concern that students would "learn incorrectly", and teacher-led tasks, the classroom may have lacked the creative opportunities, challenge and intellectually safe environment where students felt comfortable enough to fail or risk being ridiculed.

Additional Questions and Concerns

While quantitative statistics provide a definitive statistical answer to the analytical question of what happened, to whom it happened, and the ability to compare groups, quantitative results do not answer why these differences exist. In other words, quantitative analysis does not look at the social or human factors that may have caused the statistical results. In order to provide useful information that can guide classroom pedagogy, practical data that is both conceptualized and realistic is needed. Much of the qualitative results have already been combined with the quantitative questions earlier in this chapter. However, a few additional questions require discussion to fully examine some of the specific qualitative concerns. Answering these new questions is vital for teachers and school classroom gatekeepers or curriculum decision-making and the national concern over student standardized test scores.

As noted earlier in the literature review, even well intentioned analysis of students' progress can be skewed by faulty or one-sided analysis (Popham, 1999). As a result, this study was purposely designed to examine the bigger picture, using a number of research methodologies. The research process intentionally left ample opportunity for additional research questions to emerge. Emerging issues are more often qualitative than quantitative. Many of the qualitative questions in this research had to be overshadowed by the quantitative analysis, limited due to their complexity. When these questions were seen as

supporting, contrasting, or irrelevant from the quantitative results, they were categorized as suggesting the need for new research or searched for greater detail to provide more complete options and answers. The process up to this point has been answered definitively through the quantitative results. In summary, the comparison of traditional and PBL classroom research demonstrated: (a) Only small differences in overall increases in standardized test scores; (b) Larger differences in experimental group increases on the posttest for high-level (or more difficult) questions; and (c) The control group demonstrated higher increases on lower-level (or basic) questions. If the research is to be realistic and useful to students, teachers, and the schools, possible outcomes for laying the foundation for learning and variables that impact standardized test scores that may have caused these differences need closer scrutiny. Realistic answers that can be inform pedagogy requires more than a tally of statistical data.

Thus, the following issues emerged from the literature review and are included in the discussion of qualitative data. The researcher will offer reasonable causal arguments without the pretense of pretending that these explanations are anything other than possibilities. New, replicated, and more detailed research is needed in at least the following areas: (a) teacher-led classrooms; (b) lower student expectations; (c) "confusing" students with multi-disciplinary lessons and/or critical thinking lessons versus teaching basic knowledge; (d) reduced expectations to accommodate lower student reading skills; (e) narrow or simple focused for lessons; and (f) how the caring classroom promotes standardized test scores. Thus these issues, although addressed in limited scope by this research, are not intended to be complete studies, do not stand alone as appropriate

conclusions, and are used here to point out a few of the most reasonable and/or obvious reasons for the quantitative results.

Data concerning teacher and student attitudes/perspectives, engagement, researcher observation of time on task, and emerging issues have been triangulated from surveys (both written and groups discussion), video of classroom activities, taped recording of events, and researcher observation of the classrooms and the hallway discussions have been documented in explanatory matrix organized by frequency of occurrence in Table 17 and Table 18. Engagement was defined for students as interest and as engagement by students for the classroom teacher. This data is intended to broaden the snapshot of differences shown between the examination of traditional classroom methods and problem-based learning and offer some answers clarifying the statistical outcome.

Additionally, this additional data provides the opportunity to examine the limitations of this research as well as posing new questions for understanding student achievement for future research. The following questions, some of which have already been outlined earlier in the discussion of specific research groups, are examined again for greater detail:

1. Are there differences in learning enhancement identified by students and the teacher?
2. Are there differences in the types of knowledge students felt they had gained from their classroom experience?
3. Is there evidence of differences in attitudes and feelings about teaching/learning concerning community and social issues?

4. What are teacher beliefs regarding PBL, the role of the teacher, establishment of classroom environment, and/or the learning capabilities of the groups or participating students?
5. Is there evidence that these beliefs impacted student behavior or achievement on the standardized test scores?

A summary of the quantitative results shows that there were only small differences between the aggregate pre-test and posttests for all groups. However, when examined by level of difficulty for each question, it was also shown that larger differences were present. The control group scored better on the basic questions and the experimental group scored better on the questions that required higher-level thinking. Thus, this study suggests that traditional teaching methods may work better for lower levels of learning—i.e., memorization, rote learning and basic skills—while PBL may show higher scores on standardized tests when teaching higher learning skills such as construction of meaning and logic. Additionally, two of the experimental groups demonstrated considerably higher scores when all grade levels were tested, 5th, 6th, and 7th. However, scores for all groups were similar until 7th grade standards were included. On the questions designed from the 7th grade standards, the experimental groups scored higher. The disciplines advantaged for all groups clearly matched the hierarchy of goals established by NCLB (2001). However, the experimental groups, as an aggregate, scored higher in all disciplines except science and life science. Table 13, in the quantitative results section clearly demonstrates this result.

Over 82% (42 students) of the experimental groups defined the intervention as interesting with eight (8) of these students also indicating that the intervention was also fun. Eight (8) students disagreed and said they were bored. Smaller number of students indicated

that the intervention was fun but confusing (3), that they had had an opportunity to show how much they had learned or "how good" they were (3). There were also smaller numbers that indicated they felt they were given too much information at once (3) or that the intervention was confusing (3).

Interestingly, 29% (15 students) indicated that they needed more than the classroom lessons, which had been confined for the semester to Egyptian history, to succeed in The Balloon Race. A smaller number of these students (3) also realized that part of the ability to win The Balloon Race required them to plan strategy with their team members.

When students were asked specifically about teamwork 96% (49 students) wanted more of group work. Almost 30% (15) indicated that they wanted/needed more time in class to get their projects completed. One student indicated that the entire process was "distracting" but was unable to elaborate on what that meant to him. Student observations, attitudes/feelings, work analysis, and discussion of the intervention, with frequencies (F) noted in parenthesis, are outlined in the explanatory matrix in Table 17:

Table 17: Experimental Group Perceptions on Learning, Types of Knowledge Gained, and the Intervention

Qualitative Questions	*Student Interest*	*F*	*Learning Enhancement*	*F*	*Type of Knowledge*	*F*	*Civil Rights, Social Issues/ Community*	F	Impact
Student Responses									
Enjoyment	"Interesting." "Fun." "Boring." "I learned a lot more." "I had to start over" "Too much at once." "Confusing." "I can show how good I am." "Fun but confusing."	42 15 8 8 8 3 3 3 3	"Learned more." "Learned the same." "Learned less." "I learned to pick up a pyramid."	35 28 10 1	"Included other areas not covered." "More specific history." "Too much writing." "Could use creativity." "Included distance/ estimate of weight."	15 10 10 8 3			Generally expected to increase students' concentration and, thus, scores.
Relevant Learning	"Covered more than Egypt." "Needed to plan strategy."	15 3	"Needed to put together knowledge." "Hard. First part was worksheet"	10 1					Expected to increase higher-level thinking, problem resolution.
Ability to Use Knowledge			"Confusing directions. I needed more explanation." "Flight Plan was confusing." "Developing a strategy was hard for me."	5 3 2					Expected to increase prior knowledge and the ability to problem solve to create further critical thinking

(table continues)

Qualitative Questions	*Student Interest*	*F*	*Learning Enhancement*	*F*	*Type of Knowledge*	*F*	*Civil Rights, Social Issues/ Community*	F	Impact
Cooperative Learning	"Enjoyed. I want more." "Did not have time to get the project done." "Found process distracting."	49 15 1					"Other students do not have this knowledge" "I like to work alone"	3 1	Develop-ment of social and community skills would be an outcome expected.

The teacher's comments and survey answers, detailed in Table 17, emphasized her belief that more clearly defined objectives that required simple answers and/or solutions were needed. She saw the students as potentially disruptive and out of control and the smaller units of focus by a narrowly defined lesson created easily understandable units of knowledge. She was documented in an after-class interview commenting that, "Students who did not participate did so because they were overwhelmed with too much information or by a requirement to choose from several solutions or options." As an example, the intervention required students to pick up artifacts in chronological order. One of their first artifacts on their list of acquisitions was to find (and draw a picture of) a pyramid. There are three types of pyramids that are possible over three different time frames in Egyptian history. Students were required to choose (pick up/acquire) only one of the three types of pyramids. They also had to note the pyramid time frame. Next, their team needed to plug this choice into their team plan for the shortest route to pick up (in chronological order) all of the other artifacts required to finish the race. The easiest way to do this was to divide the artifacts and have every member of the team look for the date of each artifact. If one student

did all the work, it took a long time and the team was behind the other classroom teams. Some of the better students presumed that the artifacts were already listed in chronological order. If they created an itinerary directly from the list of required artifacts, they had incorrect information and had to begin again. Group assignments that actually required teamwork were unusual for these students. But, after a little prompting from other team members and helpful hints from the teacher, most of the teams understood. A few of the slower teams, particularly those where one student had taken over or where the team was not working cooperatively, had to start over and do the strategic itinerary planning over again. Students responded to any setbacks graciously and began to organize their team appropriately. Eight teams had to begin again. In the end, two were winning teams for their experimental group.

Students in the experimental groups were eager and ready to begin the race each morning. The teacher was focused on "maintaining a disciplined classroom by beginning each class with definitions." The definitions, unconnected to the intervention, were to be copied and defined from the whiteboard before students could begin group work. At the end of the race (day 4), when students became excited, she threatened to stop the intervention (4 times) and give them worksheets if they "did not settle down."

The following questions emerged from the literature review and are further conceptualized from the summary above. Qualitative data has been used to make the answers to the questions useful to pedagogy:

Q1: Are there differences in learning enhancement identified by students and the teacher?

Learning enhancements are defined as knowledge outside or beyond the curriculum or assignment. Table 17 shows students were almost evenly split in their comments and

survey answers with over 68% (35 students) indicating that they had learned more and over 54% (28 students) indicating that they had learned less. One student who had indicated that he felt he had learned less was recorded as saying, "I learned I could pick up a pyramid with a hot air balloon." The class broke into laughter and I could tell the teacher was not pleased with his answer. Students had been given verbal and written instructions to: "Pick up their artifacts by drawing a picture of the artifact." He was recorded as explaining that another teammate had drawn their team picture but he was trying to "determine how the team might be able to actually pick up and transport the actual pyramid." The class and I laughed as the young student pulled out a calculator and began estimating the weight of the pyramid and whether the hot air balloon could lift it! As the laughter subsided, this student added his complaint that he felt "the directions were too difficult" and that he "had to do too much writing" in the intervention. I ignored his complaints and asked him what he needed to know in order to lift the pyramid. He said he needed to know "how much the pyramid weighed" and "how much weight a hot air balloon could lift." I asked him to find the information on the weight of one block of a pyramid from the textbooks I had given the class. I then challenged him to find the information on how much a hot air balloon could lift—Then I gave him a hint that it was already in the directions for take-off. I told him to figure it out for extra credit. How many hot air balloons would it take? The young man was engaged and gave me an answer the next day! While this young man, in group 2, felt he learned less and supposedly did not enjoy the intervention, PBL theories on learning were reinforced since this kind of creative thinking demonstrated exactly the kind of higher-level problem resolution (albeit, humor) that the intervention hoped to create and document.

Students admitted that The Balloon Race required "combining knowledge" (10 responses on exit survey), was "hard" (1 response with other nodding heads during final interview), that the intervention "covered more than what they had been taught in class" (15 in exit interview), and that it required "deciding what needed to happen first" (3 called it strategy while 10 indicated they required "more specific history"). They were confused by the Flight Plan worksheet (Intervention Plan, Appendix 3) and needed demonstrations on how to figure mileage. While students were expected to work in teams, they were not expected to work without supervision. Thus, both the teacher and I were walking between classroom teams to assist during the intervention. As an example, figuring mileage is a 7th grade standard and not something 6th graders would have been expected to have as prior knowledge. The requirement, essential to completion of the flight plan requirement for take-off, was intended to be new knowledge created by the teams and then acquired by individuals for enhanced meaning making. In spite of this, several students in each class were already familiar with mileage. These students said they enjoyed teaching their team members how to figure mileage. The teacher(s) observed and explained when there were student questions or when students could not provide correct answers.

Teacher comments included the fact that she did not expect her students to be able to do any of this and that many of her students simply "shut down when faced with difficulty." After a day of working with students on determination of mileage, I interviewed her about having students explain ideas to each other by working in groups. She changed the subject but later indicated in an after-class interview that "while the intervention needed to be simplified, she would incorporate some of its strategies into her future teaching practice." She also emphasized that she "routinely used group work, map work, and some competitive

games that she had designed for her class." As a result, the intervention was not "too far removed from what she was already doing."

Q2: Are there differences in types of knowledge identified by students and the teacher?

During the taped exit interview in all the experimental classrooms, Table 16 documents that forty-one (41) students (79%) indicated the intervention was interesting and that they learned more; eight (8) students or 15% indicated that they learned the same, and only four (4) students or 6% said they learned less. Students also reported unanimously that they would be more likely to form study groups in the future to team study for exams and to share knowledge and ideas. Most also indicated that some of what they brought to The Balloon Race came from other classes and that this gave them an opportunity to tell their other classmates things that were of interest to them—and show off their knowledge. Over 20% (10 students) indicated that the history they learned in the intervention was more detailed than what they were being taught in the regular classroom lessons.

The teacher Commented that she saw the intervention as "something that might be beneficial for academically talented students but not for many of her slower learners." In fact, she added, "the confusion of having to make choices between options for correct answers are roadblocks to successful learning." She added that she was "the best authority for correct answers and wanted to make certain that none of her students were confused by having to make a choice between correct and incorrect responses, particularly on standardized tests." When asked to elaborate she noted that this "included answers that might not be totally corrected from peers." This response indicated to me that the teacher was more oriented toward traditional teaching than PBL and might not fully understand the term, the concept, or what it was expected to do. Higher level or critical thinking was not

going to be a priority for her without additional education.

Q3: Are there differences in attitudes and feelings about teaching/learning concerning community and social issues?

As outlined earlier in the methodology section, the teacher asked specifically that any controversial material be excluded from the intervention because she felt "they created an incentive for students to be disruptive." As a result, teaching prompts in the intervention that were designed to have student discussion of civil liberties were made more subtle and targeted community and social issues. However, social issues such as group learning and the use of humor or culture were still possible and might be observed. It was also clear that humor was minimal and that laughter was associated with unneeded noise and was seen as potentially disruptive to other nearby classes. This appeared to be reinforced by other teachers in the school. For example, during a passing period between classes, students entered the classroom and began talking about the next steps their team needed to make to win The Balloon Race. Before the bell rang, a teacher from the classroom next door entered the class and asked students to, "Sit down and be quiet." I was surprised because the bell had not yet rung, the students were not being disruptive, and they were in their own classroom. Moreover, students were on-task, albeit a bit more talkative than usual. As part of the school or district culture, this attitude would have been difficult to change.

Q 4: What are teachers beliefs regarding PBL, the role of the teacher, and classroom environment?

Rote learning and memorization was emphasized over thinking skills to prepare them for the standardized tests. This may have helped explain why control group scored higher on the basic questions while many of the experimental groups scored significantly higher on the more difficult questions. This emphasis on basic questions also leads into a caring

classroom observation and interview responses. Caring was defined by the teacher as affection. Affection is important, particularly for children who may have problems in their own homes, community, and environments. However, a caring classroom environment is also defined as one where students feel comfortable making mistakes and speaking out to express individual and creative ideas. The teacher expressed several times that wrong ideas create incorrect answers and may even lead to classroom disruptions. Thus, a caring learning environment designed to optimize critical thinking was limited. This might be seen as one of the reasons only some of the students scored higher on the standardized tests, particularly the more difficult questions.

Finally, the teacher expressed the opinion and was observed not to fully understand PBL (or the learning enhancements it was expected to teach). While this might be partly researcher-omission, the teacher initially said she understood and was familiar with all the component parts of PBL. Later, during the study, when inquiry was made again, she appeared defensive and responded that she used all of these things in the classroom. This statement was not supported by researcher observation although the teacher did appear open to new ideas. Changes in teaching methodology, however appeared to be limited by her classroom management style. She was also preoccupied with district/school requirements and may not have read the Teacher's Instructions contained in the Intervention Lesson Plan even though the same material had been given to her verbally in a day-long training session a week prior to the study. Thus, it may not have been a lack of education but rather what Popham (1999) sees as an emphasis on testing that takes precious planning time away from teachers—an emphasis on teaching to the test rather than creative teaching.

Q5: What teacher beliefs impacted student behavior or achievement?

Finally, qualitative observation, interviews, and students work differences outlined in the literature review, including increased student engagement (called student interest documented from student's perspectives), and learning enhancement, defined as the ability of students to individualize and use new information for problem resolution; were observed. Additionally, survey, interviews and follow-up for clarity and understanding of the issues was undertaken. Teacher beliefs had both positive and negative impacts on student performance. These impacts are abbreviated in Table 18 below and are discussed more fully in the explanation that follows and in Chapter 5:

Table 18: Matrix Outlining Most Frequently Cited Teacher's Beliefs

(table begins on next page)

Table 18: Matrix Outlining Most Frequently Cited Teacher's Beliefs

Qualitative Questions	*Q1. Observed Student Engagement*	*F*	*Q2. Learning Enhancement*	*F*	*Q3. Types of Knowledge Gained*	*F*	*Q4. Civil Liberties/ Social Issues*	*F*	*Projected Impact from Literature Review*
Variables that May Impact Standardized Test Scores									
A. Changing Teacher Methods: *1. Teacher-led Instruction*	"Look at me when I am giving you directions."	1	"Follow the instructions."	3					Students were observed to wait for the teacher to tell them what to do before doing any assignments even when the assignments carried over from the prior day or when there was a time constraint.
			"Stay on task."	2					
2. The Intervention					"This requires student planning."	2	"Controversial issues, such as religious customs, create conflict in my classroom. I would prefer that they were eliminated."	3	
					"My students won't be able to do this."	2			

(table continues)

Table 18: Matrix Outlining Most Frequently Cited Teacher's Beliefs

Qualitative Questions	*Q1. Observed Student Engagement*	*F*	*Q2. Learning Enhancement*	*F*	*Q3. Types of Knowledge Gained*	*F*	*Q4. Civil Liberties/ Social Issues*	*F*	*Projected Impact from Literature Review*
B.Teacher Expectations:	"One student was disadvantaged and others did not participate because students were 'overwhelmed'."	5			PBL might be overwhelming to lower performing students and the perfect challenge for high achievers."	3			While there were high expectations for some students, the entire class was delayed for the students that were identified by the teacher as lower functioning.
Need for Special Instruction	"One student did not see the daily assignment in the packet or talk to his team."	1							The pace of the classroom was slower because the teacher wanted to make sure that all students understood the lesson before moving forward.
	"Students need step-by-step directions. Students who figured out the instructions used the resources and fully understood how to proceed."	4							
C. Emphasis: Facts or Thinking?	"Make sure you look at the Board and copy today's definitions."	30	"Students 'shut down' when faced with difficulty."	2	"Students are confused when they are given incorrect answers."	1	"Enough humor. Get to work."	1	Rote learning and memorization was emphasized to prepare students for the state required standardized tests. (table continues)

Table 18: Matrix Outlining Most Frequently Cited Teacher's Beliefs

Qualitative Questions	*Q1. Observed Student Engagement*	*F*	*Q2. Learning Enhancement*	*F*	*Q3. Types of Knowledge Gained*	*F*	*Q4. Civil Liberties/ Social Issues*	*F*	*Projected Impact from Literature Review*
D. Gatekeeping Functions			"The intervention went beyond what I taught."	1	"The standards are the most important things I teach in my classroom."	1			Students were encouraged to stay with the pace of the class and not to move beyond what was specifically taught in the classroom. The standards were emphasized in the classroom.
E. Teacher Education			"I use the *same* group work, partner work, worksheets, map work, and primary and secondary sources, hands-on materials, incentives, and competitive games."	2					Teacher education regarding PBL and the scope of possibilities associated with it did not appear to be understood. More training prior to the intervention was needed.

(table continues)

Table 18: Matrix Outlining Most Frequently Cited Teacher's Beliefs

Qualitative Questions	*Q1. Observed Student Engagement*	*F*	*Q2. Learning Enhancement*	*F*	*Q3. Types of Knowledge Gained*	*F*	*Q4. Civil Liberties/ Social Issues*	*F*	*Projected Impact from Literature Review*
Teacher's Behavior and Actions	Emphasized direct, simple teacher-led explanations for all tasks over group discussions of alternative answers. Emphasized definitions and teacher-led activities over big ideas.	10 10	Emphasized classroom control over student engagement. Threatened to end intervention when students became enthusiastic and did not wait for true disruptive behavior. Answered questions posed for class discussion before the class could answer.	35 10 7	Felt that over 50% of her students were low-performers, particularly in reading and language arts.	5	Civic concerns, controversial issues, and things that might be directly connected to cultural differences were purposely omitted from the classroom.	10	Students were provided with a basic education consistent with current standards for 6th grade in this classroom. However, high-level thinking skills were not encouraged or expected.

Discussion of Teachers' Beliefs

One criticism of any academic discussion on teachers' beliefs or attitudes has already been suggested in the literature review. That is, that a clear definition of exactly what teacher's beliefs actually means is not fully agreed upon by all researchers. For purposes of this research, Pajares (1992) suggestion from his study suggests that beliefs function as a way to explain the world and how it works. Thus, the teachers' beliefs are those that allow him/her to explain students' behavior, the classroom environment and structure, and even the definition of academic achievement. Observations for this research did not limit itself to a specific, agreed upon definition. Rather any behaviors, attitude, or other factor likely to impact the intervention or student scores on tests, including such things as a dislike of complicated issues, were also included when they appeared numerous times during the study. Also included are statements by the teacher that lead to conclusions about the teacher's knowledge of PBL.

In spite of conclusions that led me to feel that higher-level learning might be limited because of rigid classroom discipline, I was impressed by the level of affection shown by this teacher to many of her students. They appeared to appreciate this bond and returned it. Students listened when she talked, laughed at her jokes when they were offered, and appeared to enjoy her classroom. A few components of urban teaching were being applied in her classroom. Genuine concern for her students was evident.

However, there is a difference between affection and willingness to accept challenging ideas. I observed that students only offered creative comments once during the five days I observed the classroom. While some students did approach the teacher individually, this lack of spontaneous creativity suggested that the environment could use

more flexibility. The original question for qualitative analysis was to examine potential reasons why Group 3 and Group 4 scored higher on the standardized posttest. Some answers may be found in looking at the groups and the differences in the process of the intervention and group perceptions. This qualitative discussion of each of the research groups has been included with the quantitative results and Tables showing group test scores beginning on page 121.

Impacts that were documented that seemed to classify the teacher as traditional were the preference for teacher-led and detail-focused lessons. These beliefs, when put into classroom behavior, do not fit PBL theory or the advancement of higher-level thinking. Delaying studies until the entire class understood is a good strategy but some accommodation needs to be made for students who are not struggling and who may become bored. Individualized learning was not observed and, while the teacher emphasized teaching the state standards, it was clear that students were far behind their peers. Although some students were making progress in reading, the teacher did not have a plan in place to complete the standards by the end of the school year. Group learning might have assisted in engaging, motivating, and moving some students forward. However, it was rejected because students might incorporate incorrect knowledge from their peers.

In conclusion, the study identified teacher's beliefs and student engagement to be the most important factors to explain differences between the standardized test results between the research and the control groups. As noted earlier, while voicing enthusiastic support for group work in the classroom, the teacher said, "Students needed direct, specific, and simple explanations for every task rather than group discovery or big ideas." This belief directly conflicts with the theories of PBL. It helps to explain why the students in the control

classroom scored higher on the lower difficulty questions and may also help to explain why some of the other experimental groups, particularly groups 1 and 2 failed to score higher on the higher difficulty questions. The teacher's focus on narrow concepts, limited expectations for some students, belief that interdisciplinary teaching, the introductions of controversial issues and even laughter might create confusion was creating a climate of low expectations. In an academic environment where limited expectations are the norm, higher scores on standardized tests for the lower level difficulty questions involving facts and memorized answers might seem safer for the classroom—and the teacher. Giving students the option to individualize learning opens the door to the idea that what is learned may not be what is taught on the exam. Moreover, if the exam is primarily multiple choice, then what needs to be known are simple facts. Without constructed response questions, or where constructed response is only a small part of the test, emphasizing the standards is vital. Allowing student to break out of what has been traditionally expected opens both the students and the teacher to uncertainty, potential ridicule when student's answers are incorrect, and moves students and teachers into issues that may feel uncomfortable and threatening. This is particularly true if the school or district culture is having some success with traditional standardized tests and school conduct.

It was also evident from the teacher's preoccupation with the end of the semester MAP tests that the district required high-stakes testing was occupying a great deal of her time and efforts. This was observed and reinforced by interview as creating stress for the teacher. The preoccupation did not allow her to prepare lessons or teach creatively. She and her students were being shortchanged by demands for increasing student achievement.

Observation and the teacher's comments demonstrated that increased teacher education and understanding behind PBL theory along with the implementation process for the intervention was needed. While research observation time during the experiment was limited, additional time was needed to properly orient the major implementer, the teacher, also. It was clear that many of the decision-makers who had approved the research were not fully aware of what PBL was. This turned out to be a major issue and probably one that should have been anticipated.

CHAPTER V

DISCUSSION OF RESULTS

This chapter will seek to explain and conceptualize the findings on the differences in test scores of PBL and traditional classrooms with the goal of extending our understanding of the impact of Problem-based Learning programs on student learning and informing teaching practice for practical use in the classroom. The organization of the chapter will be to initially summarize the overall goals and results of the study. In addition, potential reasons why some students increased their test scores will be discussed. Finally, there will be a discussion of possible barriers or problems students who did not increase their standardized test scores may have encountered. Discussions will be organized using the initial research questions and the results detailed in Chapter 4. Special emphasis will be on the qualitative data and the four qualitative questions when compared to teachers' beliefs identified by observation, survey, interviews, recorded comments, student work, and comments during the study. The most significant finding from this study is that the use of problem-based learning can increase standardized test scores. This is true for initially low-scoring students and disadvantaged groups and when increasing higher-thinking skills is a classroom goal. This result provides support for PBL teachers who are concerned that they may be shortchanging their students by using a teaching method that may not provide the increased standardized test scores teachers need to demonstrate competence or which their students need to progress academically.

A review of the differences found between traditional classroom teaching methods and problem-based learning results from the quantitative analysis suggested three conclusions:

A. Only small differences in overall increases in standardized test scores were associated with some experimental groups;
B. The experimental groups demonstrated higher increased scores on the posttest for higher-level thinking and the harder questions; and
C. The control group appeared to have higher increases on low-level questions, but the small n prevents concluding so with any certainty.

However, explanations or implications for pedagogy cannot be established determined from data that only measures increased or decreased scores. Realistic and classroom appropriate lesson planning data must be deduced from qualitative sources to make these results implementable by teachers. Generally, two additional statistical results are also suggested when examining the relationship of PBL to standardized test scores:

A. While the overall scores comparing the experimental and control groups are statistically too close to indicate meaningful differences, if the student (community-oriented) group 2 is excluded, a greater aggregate increase by the experimental groups over the control is easily shown. The argument for excluding group 2 for discussion purposes, noted in the group results in Chapter 4, can be posed because this group may have determined as a group to discount the intervention when they discovered that the results had no impact on their permanent records or their school grade. Additionally, some of them expressed the concern that the researcher was going to examine their personal school records.

B. It is not accurate to conclude simply that PBL may support higher-level difficulty while traditional teaching methods support the lower level thinking skills. Other factors may be contributing. These also need to be examined qualitatively.

This study was intended to go beyond quantitative conclusions and explore, using qualitative methods, reasonable data that further explains the quantitative results. This chapter will align these reasonable explanations from the qualitative data with the literature review and discuss what has been learned. Qualitative data that includes both researcher and teacher observations, recorded comments from students and teachers, surveys, interviews, class work, and test scores; begins to provide realistic data that can be used to inform teaching pedagogy. In this chapter, this data is summarized based on what has been learned the literature review and from the results of the study. Because of the limitations of this study, any conclusions may only be applied to this research and only for these specific students at the time and place of this study. The results cannot be expanded to the larger populations, such as 6th grade students in another school district, without replication. An additional limitation of the study is that the control group, aside from having a very small number of subjects, may not be a standard academic population. The following Table is a summary comparing the standard deviations, the range of scores on the posttest, and the number of subjects for each group. It clearly demonstrates that the control group not only does not have the normal standard deviation but also that the range of scores is very narrow even when compared with group 2, which has a very similar number of subjects.

Table 19: Summary Comparison of Aggregate Test Scores by Group

Group	Mean Increase	Standard Deviation	Range of Posttest Scores	N
Control	5.25	5.08323	12-26	8
Group 1	4.4	9.867	7-39	15
Group 2	1.8	11.802	6-42	10
Group 3	8.0	9.843	7-42	12
Group 4	6.187	10.570	8-46	16

In spite of this suggestion that the control group is not standard, however, the results are suggestive of broader implications. However, prior to more detailed discussion of the qualitative conclusions, it is important to establish that the research question is defined by *differences* in standardized test results. This researcher was not able to establish with complete certainty that any one variable, issue, or component was totally responsible for student achievement on the standardized test instrument. However, there were variables, issues, and components that appeared to establish an environment (or outcome) for learning but did not directly impact the standardized test scores. Conversely, there were other variables, issues, and components that had some potential to create change in student achievement on the standardized test instrument. This list is not infallible or even comprehensive. It can only be termed as reasonable by the researcher. These are provided as a general overview and then discussed in more detail in the subheadings that follow. Within this context, the following, included from the collected qualitative data and detailed

in Table 17 and Table 18; appeared to be general outcomes of the intervention that can be seen as setting the stage for learning but not necessarily directly impacting standardized test scores:

A. Student engagement or interest in the lesson was increased in the groups exposed to the intervention;
B. Learning enhancement or components in the lesson was demonstrated in posttest results that demonstrated knowledge that went beyond the curriculum
C. Types of knowledge emphasized or teaching to different "intelligences" or relevancy to student prior knowledge;
D. Social issues or immediate student relevance;
E. Caring classroom or a welcoming, non-threatening learning environment; and
F. Teacher education or the teacher's knowledge of the subject and/or willingness to change teaching methodologies.

Again, within the limitations of the study, variables that appeared to directly impact standardized test scores were as follows:

A. Teacher-led instruction or the ability of the teacher to allow students to personalize their own answers rather than teacher-emphasis on seeing the world on through the teacher's eyes;
B. Teacher expectations or the teacher-perceived need for individualized or special instructions.
C. Emphasis in lessons on facts over thinking and
D. Gatekeeping functions that limit what is taught in class.

Intervention Outcomes that Can be Seen as Setting the Stage for Learning

A. Caring Classroom/Environment

A caring classroom and caring learning environment is generally defined as one where students feel safe to offer ideas without ridicule or facing either peer or teacher disapproval. It was clear that the teacher was genuinely affectionate towards all her students and she defined a caring environment as one of "affection." On the other hand, students, documented by videotapes responses, interviews, and researcher observation, did not feel comfortable making mistakes or offering creative ideas. Over fifty-two (52) instances on caring classroom environment were documented. Only eight (8) of those were positive comments and an additional seven (7) concerned the teacher's emphasis on classroom control. It became clear that the classroom, while controlled for misbehavior, also inhibited student ability to express individual thinking.

Observations concerning overly controlling classroom management strategies were at least partially offset by evidence of genuine affection and concern for students in the research classrooms defined as a component of the caring classroom from the literature review indicate that a caring environment also includes the opportunity to make mistakes and try again. This appeared to be lacking in the research classrooms. Students were not given the opportunity to re-do assignments and the emphasis in all research groups was on getting the correct answer. This was demonstrated by the teachers comments during an after-class interview with the researcher where she said, "I don't want them to get the wrong answer from other students" and "Students are confused when given incorrect answers."

It has already been documented that this teacher emphasized narrowly focused lesson plans with only one idea and basic skills such a rote learning and memorization. However,

researcher observation clearly demonstrated that she coupled this narrow lesson plan goal setting and emphasis on classroom management with affection. This was demonstrated by short hugs, comments recorded in the classroom such as, "I like you," and genuine concern for lower-performing students. These factors might help explain the increased scores by the control group for the lower levels of difficulty on the standardized posttest. These students, in an effort to please their teacher, may be more attentive regardless of the appeal of the lesson. As noted in the literature review earlier, classroom control and nurturance interact to impact both student engagement and student learning. Both control and nurturance influence student outcomes as well as improving the school environment. This alternative explanation for the lower level standardized tests scores also suggests that further study is needed. Further, the nurturing environment established by the classroom teacher and her own belief in emphasizing basic skills, documented from recorded teacher comments, interview, and teacher written comments, might be still another reason for higher scores at the lower levels of difficulty by the control group. Future research comparing these two classroom environmental components on the development of basic knowledge skills/higher-level thinking for lesson planning and curriculum creation will be vital for teachers and schools concerned about student standardized test scores and the global competiveness of their students.

B. Types of Knowledge Gained

This research also suggests that traditional methods may be better when the goal is to teach basic skills while PBL may be better for teaching higher levels of thinking. Students need to be exposed to knowledge that encourages development of problem-solving and critical thinking. This is true regardless of whether their intent is to be a truck driver or a

professor. On the other hand, higher scores on basic questions may be a manifestation of only this particular study, the participants of only this research, or they could be an outcome of the teacher's emphasis on smaller details and memorization of fundamental facts, such as definitions. The question is: "When faced with low performing students, is it better to concentrate on lower difficulty skills with the rationale that at bare minimum, all students are learning something?" This is a policy issue but it is a vital one for future research.

When the exam questions are broken into grade levels based on state and national standards according to CTB, more students in the experimental PBL classrooms chose correct answers at every grade level tested, 5^{th}, 6^{th}, and 7^{th} grade. Since these are middle of the year 6^{th} graders who did not choose any correct answers at the 7^{th} grade level on the pre-test, the fact that the experimental groups are scoring correctly at the 7^{th} grade level again points to the conclusion that higher performance and higher levels of thinking may be supported by PBL.

When student correct answers were analyzed, from the most correct answers to the least by academic discipline, both the control group and the experimental groups demonstrated similar subject area hierarchies: reading/language arts, first; math, second; science, third; and, finally social studies. This hierarchy emphasis is in keeping with the 2001 No Child Left Behind policy. This supports the conclusion that the national emphasis on higher standardized test scores with their hierarchy of emphasis in reading and math are not compromised by either PBL or traditional classroom teaching methodologies. This is important because of the evidence that standardized testing—and even the connection of the results of these tests to specific teachers—are not diminishing and will continue to be bigger issues that will need much more study.

C. Student Engagement

Student engagement (and interest) was increased in the experimental groups. Additionally, qualitative analysis of student engagement may not have been as strong due to the teacher's expectation of limited student interest related to her perception that the complexity of the intervention was "overwhelming" and her perception that her students, generally, were "low performers."

Contrary to teacher perception, observation and student survey responses clearly demonstrate that students enjoyed The Balloon Race. This was demonstrated by student interviews and comments that they felt they "should have had a longer time to finish the intervention." Further, timing on-task behavior supported what PBL theorists have identified as a strength of PBL. Increased student engagement was observed and documented by this research. Although some educators might argue that attracting the student's attention is all that is required to change a disinterested student into one who is engaged or on-task, students need more than mere interest. It is important to emphasize that to use new information, students need to tie new knowledge gained to previous knowledge. Defining student engagement as simply "interest" has not been seen to increase academic performance by itself and has also not been shown to be evidence of learning. The posttest standardized test scores do appear to demonstrate learning as well as engagement during this study.

D. Learning Enhancement

Learning enhancement identified by students and the teacher was a major focus of this research. The majority of students (approximately 80%) reported learning more than

social studies because they were challenged. Interviews with the teacher showed that she felt the students required more narrow and simplified lessons because they were underachievers. She felt her students would be unable to perform complicated tasks or absorb complex issues. Yet group 3 and group 4 demonstrated their ability to handle difficulty both on the standardized tests and on the daily assignments associated with The Balloon Race. The small differences between two of the experimental groups (group 1 and group 2) and the control group may be a manifestation of low expectations. Low expectations can lead to lower academic performance when students are convinced they "just don't measure up."

Variables that May Impact Standardized Test Scores

A. Changing Teaching Methods/Resistance to Change

Two of the most significant components observed by the research that would impact standardized test scores were teacher-led instruction and the teacher's feeling about the intervention itself. These components heavily impacted the answers to higher-level or the more difficult test questions because some students were observed to wait for the teacher to tell them what to do and how to answer questions. This was seen to delay beginning assignments or take charge of their own learning. Over six (6) instances of teacher-led instruction were observed and over seven (7) instances of resistance to the intervention expressed by the teacher were documented. Additionally, the teacher, documented by written interview and recorded verbal comments, verified that while appearing to be open to teaching methodology changes, any use of PBL in the future would be small, incremental, and, of course, adhere to school cultural norms. Three (3) instances of the teacher indicating that she would "modify" or use "parts of" the intervention were documented.

However, as the study progressed, the teacher's answers to interview questions appeared to demonstrate less resistance to PBL instructional components that she had previously seen as objectionable. For example, at the beginning of the study the teacher was concerned students would not be able to "plan" or that the lesson unit was "too complicated." However, she commented that she would use "parts of the intervention" in future classroom activities. As a result, the researcher hypothesized teacher recognition of what the teacher identified as "a few better ways" of teaching. On the other hand, researcher observations, interviews and comments from other teachers confirmed a strong school management culture that emphasized state-mandated standardized test results over creative classroom teaching. This is consistent with previous research that has found that longstanding teacher beliefs and behavioral changes in the classroom would need to be required/initiated from within the school or district before any significant classroom changes would happen. This was also confirmed by follow-up verbal discussions with the teacher where she said she would use only "some of the ideas" in her future teaching plans. The literature review strongly suggests that even when initiated by the district, such changes just do not happen. Implementation of PBL for faculty and in educating teachers, observation and numerous follow-ups is a vital and often neglected component for success. Such educational efforts require the full support of the school and the district. Even so, prior teacher education in teaching methodology and, particularly PBL, by the researcher might have made the short time frame of this study more effective.

Additionally, it was observed from both the posttest scores as well as student and teacher comments, that the classes taught later in the day—after the teacher had more practice teaching the intervention—scored better. Thus, one of the reasons for differences in

scores between the experimental groups may be attributed to better preparation by the teacher simply because she had practiced the same lesson two or three times before she taught the higher performing groups, group 3 and group 4. Group 3 and group 4 were also observed to receive less correction. This factor may be because the teacher expectations, documented by after-class interviews and recorded comments, were higher for these two groups. As a result, the teacher spent less time lecturing and more time was allowed for student discussion. This is also documented by more time on-task (15 – 30 minutes) than the other groups.

Again, educating teachers for understanding about PBL and how to implement it presented a major barrier in this research. Teachers teach the way they were taught and will change only when they recognize that there may be a better way. Demonstrating the results of "a better way" is needed. While the teacher documented her own attitude change about PBL being "a better way", she was reluctant to change all of her preconceived beliefs about some of the component parts. For example, she remained firm that "controversial issues, such as religion, customs, or community issues" not be included in lessons. This did not change in spite of three separate interview questions about them spaced over the six-day study. Additionally, open-ended questions or questions that had more than one answer were also suspect because of her belief, documented by after class interviews twice that, "Students shut down when faced with difficulty." Therefore, the challenges that are part of PBL were being discounted and eliminated by the teacher's gatekeeping in spite of the fact that she could see student improvement. As a result, if the district decides that PBL is to be encouraged, follow-up observation after training for teachers will also be needed.

B. Teacher's Expectations

Teacher's expectations included the documentation of high expectations for some students and the teacher's concern for the need for special instruction for others. In general, this impacted standardized test scores by limiting what was presented to all students in the classroom. The entire class, for example, was documented from teacher interviews, comments and from researcher observation, that introduction of new knowledge was delayed to allow lower functioning students to catch up and to make certain that all students understood the lesson from the teacher's perspective. Eight (8) instances of documentation of teacher's perspective that students were "overwhelmed" by the intervention and an additional five (5) instances of teacher concern for the need for specialized instruction were documented.

A review of the participant teacher expectations demonstrates that while the quantitative results did not show important gains (less than 3% for all groups) by either the traditional classroom method or the PBL classrooms, the question of why some groups scored higher on the more difficult test questions may be partially answered by teacher expectations. In spite of the fact that the control group scored in the middle of the hierarchy of averages on the aggregate posttest results, there is an observable difference in the experimental standardized test scores on the type of questions or level of difficulty that students attempted to answer. The experimental groups demonstrated correct answers at the higher level of difficulty on the posttest ranging from 31.8% to 54.1% compared to 33.8% increase in the control group. As the level of difficulty of the questions increased, the percentage of corrected answers on the posttest decreased for the control with the former demonstrating their highest increase of 67% at level 24 and the experimental groups increasing to 100% at level 26. Conversely, on the lower level questions, the control group

increased their correct answers by 47.8% while the experimental group increased ranged from 16.9% to only 31%. Since the initial pre-test scores of the control group and experimental groups were approximately the same, these increases at the lower levels cannot be dismissed as a fluke. At these lower levels, the control group demonstrated a 100% increase at level 3 while the experimental group increased to100% at level 4. Did the intervention, perhaps because of its emphasis on new knowledge created from individualized learning in a group setting, have an added benefit of encouraging risk-taking even when the classroom was tightly controlled for "correct answers?"

The statistical analysis on overall (aggregated) standardized test scores demonstrated only minimal gains for the experimental groups. One experimental group actually scored almost the same as the control group while another group had lower scores than the control. Students that were quicker to understand new ideas and identified by the teacher as her "better students" would be expected to score higher even in the short timeframe of the study. A longer timeframe for the intervention might have allowed time to observe if other students, perhaps less academically advantaged, to improve their posttest scores. Over 80% of the students in the post-study interviews indicated that they would have preferred to have a longer time for the intervention. Some of this may be attributed to the fact that these students had been "maxed out" with tests during the last two weeks of school and one more test was, as one student described it, "just boring!" Regardless, there is no evidence to suggest that students would have reduced their scores had the intervention been extended and some, no doubt, would have increased their scores.

Interestingly, group 3, the highest scoring group was *not* identified by the teacher as her most advanced or academically advantaged group. Student interviews documented that

they did not feel challenged as learners. Thus, another research question emerges, "Does PBL lend itself more easily to academically advanced students?" This conclusion is not supported by this research. Consider the teacher's concern about one slow reader in group 2. This teacher-designated slow reader, let's call her Susan, was a member of an experimental group classroom winning team in The Balloon Race intervention. The expectation expressed to the researcher by the teacher was that this student would not do well on either the pre- or posttest. In fact, her per-test score was quite low (with only 3 questions answered correctly). Yet, this student increased her posttest score by over thirteen (+13) points or nine (9) points over the average score of the aggregate! When interviewed by the researcher, Susan indicated that her teammates were very helpful in explaining concepts, that she enjoyed the intervention, and that she had "more opportunity" to obtain answers when placed in the team.

In spite of the need for a very loose interpretation of the conclusions, the facts do not support the teacher's recorded comments that students were "overwhelmed", " do not understand", and "are confused." While the short period of time for the study did lead to some student confusion that a more relaxed study might have helped alleviate; over 80% of the students rallied to the challenge of a very complex assignment quickly and commented verbally that they enjoyed the intervention and felt that had learned more than they normally did.

One student in the class had been mainstreamed in spite of the teacher's concerns that this student needed an IEP and should not placed in her class. This student was not readily accepted by his teammates and was referred to as "different." The literature suggests that many borderline students benefit greatly when placed in welcoming environments. This

student, however, was never fully accepted. With more and more diverse students entering public schools with special needs, it should be a concern when capable teachers decline to change methodologies, choosing, instead, to place these students in tightly controlled classrooms. The teacher's concern, expressed in interview, was that this student was "confusing other students and slowing the pace of the classroom." This student, assigned to a team in group 2, was not allowed to participate with his teammates during the intervention and was placed in a desk, alone, at the front of the class. While his answers were consistently incorrect, he did not appear to have any obnoxious behaviors beyond being unfocused. He complained during the post-study interview that he "never even had a chance to participate" in the intervention. He took the pre-test but was absent for the posttest so any difference in his scores could not be determined. While this teacher was obviously frustrated with this student's behavior, a more relaxed attitude toward incorrect answers may have helped both the student and his teammates. As a result, along with new emphasis on diversifying teaching methodologies in our schools of education, more emphasis on the methodology of a welcoming classroom environment for all students may be needed.

The research also demonstrated that the teacher's expression of frustration or negative feelings inhibits student engagement. It might be argued from observing group 2 (and the control group) that the lower scoring groups might be reflecting the lack of confidence communicated by the teacher to her students by recorded comments such as, "I've had enough of you today," the suggestion that they were "slow readers", or that their standardized test scores were "low." Teacher beliefs, including the statement that students need to have all instructions read to them by the teacher and that students are incapable of higher-level logic or challenging assignments, demonstrate lowered expectations for

students. While some of this can be justified as individualizing learning, students have been shown to live up to low expectations.

Consistent with finding from previous studies, the teacher's written survey comments and supported by observation, showed that students were not allowed any opportunity to fail and may result in limited intellectual growth due to the narrow focus of lesson plans based on teacher's perspective. The limitations on what is taught or the gatekeeping function in the classroom may be a major contributing factor to the increased lower level of difficulty scores on the intervention posttest. Thus, if the goal is to increase only basic learning, the methodology is working.

C. Emphasis: Facts or Thinking?

Rote learning and memorization was emphasized to prepare students for the state required standardized tests and documented from teacher interviews, comments, and observation. This emphasis would impact the differences between increases on higher level and lower level questions on the standardized posttest. Over thirty-four (34) instances of emphasis on basic skill questions were documented during the research.

Challenging students with The Balloon Race created excitement—both negative and positive. Two teams in group 3 were so excited that they knocked the wall map needed for their assigned flight plan onto the floor. Some of the students were embarrassed while others were concerned that the teacher would stop the intervention. The map was quickly placed on the floor and students moved desks so they could crawl onto the map to finish their trips. The process took less than a minute and was not noisy. However, the teacher was distressed. She indicated in an after-class interview that she did "not stop the intervention because it was group 3 and they were her better students." Teachers who are

afraid of a noisy or busy classroom may be reluctant to challenge their students for fear of losing control or of being seen by students, school, and the district as a teacher who cannot control or manage her students. This may mean retraining our teachers to use, not the same methods their teachers used, but to include teaching methods that can support reasonable classroom chaos, as appropriate, and encourage complex and higher-level thinking.

This leads to a discussion of the differences shown in the types of knowledge students felt they had gained and comments made by the higher scoring students in both group 3 and group 4. These higher scoring experimental groups were clearly excited about the fact that they needed to create their own strategy to win The Balloon Race. The answers were not given to them. Furthermore, more than one answer was correct. While they had the support and knowledge of their peers, no clear-cut correct answers were provided from the traditional academic resources they used in their classroom. This forced them to think, organize, and plan in order to travel from place to place by hot air balloon in the ancient world. It also meant they could interpret data incorrectly, come up with wrong answers, fail, and have to begin all over again to get it correct. This does not provide the perfect environment for a teacher—or students—who expect only concrete and academically correct responses!

This research is not confined only to student interest in the lesson. What is supported from this research and the literature is that PBL does provide more on-task behavior than traditional teaching methods while the level of difficulty results suggest that potential for learning may be tied more strongly to student attention than the literature has suggested or allowed. While this appears to be a reasonable conclusion from this research, more study is needed before these conclusions can be generalized to other populations.

D. Gatekeeping Functions

Standardized test scores, as noted previously, would have been impacted by the gatekeeping role of the teacher which included documentation that students were encouraged to pace their learning to what was specifically taught in the classroom. Students were not given support to move beyond these limits to acquire new knowledge related to individual interests. The teacher, in interviews and comments, documented her focus on the standards and even concerns that the intervention "went beyond" what she had taught in the classroom.

Students were also limited by the gatekeeping function because the teacher had reduced the first half of the annual curriculum content to focus only on ancient Egypt. This may have created an artificial intellectual barrier to student identification of individual interests, more detailed exploration into areas not presented in class, or even new knowledge identified by the adopted state and national standards. The intervention was seen by the students as allowing them to use their strongest intelligences, display these individual skills to their peers, gain new knowledge from a variety of sources, and to problem solve using their own resources. Student recorded comments and during interviews documented comments such as "This was interesting," "It covered more than Egypt," "This required planning…and strategy", "I can show how good I am," and "I can use creativity." Negative comments included that the intervention required "too much writing," and was "hard."

Finally, the study may have been biased by the teacher's expectation that the researcher would take over during the study as the teacher for the classroom. Undoubtedly this misunderstanding was at least partially the researcher's fault for indicating that assistance was possible. A clear understanding was not established as to what assistance

was appropriate because the researcher assumed that the teacher was aware of what the researcher's role needed to be. Additionally, other tasks, such as grading and the state required MAP test, were taking the teacher's best efforts away from her students and removing the focus from the classroom. It was clear that the teacher was facing a struggle to complete district-required paperwork. She commented at the end of the pre-test, "Can you take over the class tomorrow because I need to finish this paperwork?" Some researchers references earlier see this as a major flaw in the emphasis on standardized testing. He also notes that the use of standardized test scores to evaluate teachers is hurting the teachers, the schools, and the students because it removes teachers from their major goal—teaching the students. The schools and classroom teacher are far too focused on standardized testing and paperwork. It replaces needed emphasis on true learning. The students in this research faced at least four (4) standardized tests in a two-week period before and during the study!

The classroom teacher in this research minimized attitudes and feelings about teaching/learning concerning civil liberties. This was explained by the teacher as needed to "make sure students did not get out of control and disturb the classroom environment." Teacher education already emphasizes that future teachers are aware of the need for play, peer learning, and social issues that allow them to develop as fully functioning members of society. Additionally, they need to understand that some cultures are more vocal than others. Understanding that all knowledge does not reside with the teacher may be a key component in the creation of a caring classroom.

E. Teacher Education

As noted in the literature review earlier, the vast majority of teachers certified in the classroom have the knowledge required to teach their chosen discipline. This knowledge is

obtained through their academic training, the certification process, and from in-service training after they are in the classroom. What appears to be missing, as noted in the literature review and by this research, is teacher understanding of how and when to use various teaching methodologies. This is needed to be able to individualize learning for students. This research demonstrated clear differences between what the teacher understood as PBL (which she defined as group learning) and the scope of component teaching methodologies included in the PBL intervention. This was documented by over two (2) instances of the teacher indicating, "I use the same group work, partner work, worksheets, map work, and primary and secondary sources, hands-on materials, incentives, and competitive games." Differences in use and ability to use group and partner assignments, map work which included 7th grade standards, and calling the intervention a "game" demonstrate serious differences in understanding of the PBL goals as well as only preliminary knowledge of the teaching methodology. Teachers are reluctant to admit, as this teacher did, when they do not have knowledge of a specific methodology or that their use of a methodology might benefit from tweaking, observation, and/or practice.

In summary, while I have suggested that the major variables for impacting standardized test scores are changing or resistance to changing teacher methods, teacher expectations, emphasis on facts or thinking in the classroom, and the teacher's role as gatekeeper for what is taught in the classroom; this cannot be the total concern when examining student achievement on standardized test. Other factors also play significant roles in determining whether a particular teaching methodology, such as PBL, will be effective. These components include a classroom that welcomes discussion of ideas and where students feel comfortable (a caring classroom), types of knowledge offered and

gained, student engagement or interest, and learning enhancement or whether student learning is expanded.

The qualitative data suggest that the study of student standardized test score research when comparing pedagogies raises the suggestion that our traditional teaching methodologies may be unduly limiting student potential. While this research conclusion cannot be generalized outside of this existing research population, it is not difficult to imagine that the low expectations, limited pedagogy methodologies, emphasis on answering fact-based questions, and gatekeeping designed to limit student interaction and participation in their own learning may extend beyond one school, one classroom, one race, or one type or level of intelligence. Thus using only one or two teaching methodologies for teaching may limit the learning capabilities of our students. What this research has demonstrated is that classroom teachers need not avoid teaching methodologies like PBL due to fear of negatively influencing standardized test scores.

Discussion of Limitations, Future Research and Concluding Thoughts

The question of whether differences on standardized tests can be shown when comparing traditional classroom teaching methodologies and PBL, using only this research, must be considered preliminary because of the short period of observation and limitations placed on it by the district's schedule of MAP testing, the short period of time between the pre-test and the posttest, and the nature of the controls placed on the intervention (i.e., limiting social issues to minimize unruly behavior), teacher attitudes, and limited student work may have created an incomplete picture and limited results. A major concern for statistical validity is the small number of subjects in the control group. As a result of the small Ns, all estimates of variable values for the comparison group are likely to have large

confidence intervals. Thus the quantitative results when comparing the control group and the experimental groups are likely to be skewed. For the level of difficulty results, however, the small differences shown are enhanced or supported by the similar statistical results when the outliers are made a part of the analysis. As outlined earlier, statistical significance is also not as important to social science research as it is to scientific research. Rather, it is repeated research with similar (replicated) conclusions that are importation. The study does have merit in that it provides new data on the potential PBL link to higher-level thinking as well as a link for traditional teaching to basic skill acquisition shown from standardized tests. It is important for teachers to know that the use of non-traditional teaching methods will not "waste classroom time" or lower standardized test scores.

Additionally, the introduction of the researcher into a classroom-teaching role, albeit only for a short period of time, may have biased the results. Because of these limitations, findings should be considered preliminary. In spite of these serious concerns, the research has merit to suggest replication and the need for more in-depth study, particularly in the areas of level of difficulty of the questions on the standardized tests and higher levels of thinking.

A pre-test/posttest research design typically separates the tests by a minimum of two weeks. This study was reduced from ten (10) days to five (5) days because of teacher and district scheduling. The posttest was given on the 6^{th} day after the pre-test. This creates an opportunity for error because the average student will recall some of the test questions given earlier and should, if only by virtue of having seen the questions previously, perform better on the posttest. This error is partially offset in that both the control and the experimental groups had the same advantage of recall. Moreover, neither the students nor the teacher

were given the correct answers to the test questions until after the posttest. Additionally, students who do not test well on the pre-test may have a statistical advantage to increase scores on a posttest because the lower scoring students have more possibilities of correct answers on the posttest. For example, students who score 41 out of 47 points on the exam can only increase their score by 5 points. This can create a disadvantage for high performing students because of a "ceiling effect." However, this known advantage was not evidenced in the lower scoring pre-tests of the control group because the standardized test used by the intervention also included questions designed from the 7th grade standards. Additionally, great care was taken to make certain that the teacher did not have a copy of the exam and that students did not have an opportunity to learn which questions they missed on the pre-test until after the posttest was taken. Students were heard and observed discussing and comparing answers in the hallways before and after the exams. This was expected and no attempt was made to control student discussion of what they felt were correct responses. It was seen by the researcher as part of the learning process and documented as community/group collaboration outside the intervention.

Teacher attitude/perspective and the shortened time allowed for the intervention may have created an incomplete picture or limited the results in this study. Observations such as shortening the time allowed for student work on the intervention, not allowing discussion of civic issues, excessive control of the classroom, and major emphasis on teacher-led and rote learning may have been reduced if the study had been longer or had the researcher had more time for teacher education in the classroom prior to the introduction of the intervention.

Finally, this study was necessarily complex. Early assumptions were made (and verbally verified) that the instructor for the groups had considerable experience and training

in group teaching and cooperative learning methodologies. It became increasingly clear as the study progressed that the researcher definition of group learning and the teacher's understanding of group learning were quite different. Furthermore, group learning and PBL are not the same teaching method even though they use some of the same teaching techniques, components, and goals. While the teacher is a quality teacher, her definition, and that of the district/school culture, regarding what constitutes quality classroom control included methods/goals that can be viewed as roadblocks for a PBL approach to learning and higher-level learning. In spite of this fact, the results of the study did provide some preliminary findings about the relationship of PBL and traditional teaching methods to standardized tests. Specifically, it documented that teachers do not have worry about standardized test scores or be tied to teacher-led methodologies when they choose to use PBL in the classroom.

Lecture and recitation and classrooms where the teacher was in control has been identified as the dominant teaching method. Moreover, most of the questions posed to the classroom were lower-level and factual with new information obtained from the textbook. This appears to be highly effective when teachers require students to demonstrate comprehension, analyze and then apply the information. Additionally, when wait times are short and rewards are significant, students may focus only on doing totally on the expectations or wants of the teacher. Some of these same researchers support the idea that a focused lesson plan objective was the most important teaching strategy to improve student achievement. Later research also supports more controlled teaching emphasizing information and skill transfer in conventional classrooms involving clearly defined goals and

objectives were preferred by students who were serious and who excelled because of the low-risk to grades or peer recognition.

However, the greatest benefit to using the traditional methods may be in what appears to some as an answer to public opinion trends of the last fifty years that show that classroom discipline is one of American public education's major concerns. However, tightly controlled classroom management techniques may limit the results of some teaching methodologies, such as PBL, as much or more as the teaching methodology used. In this research, it was evident that the teacher was uncomfortable with noisy and active students in the classroom. Additionally, the level of classroom control that appeared to demonstrate good classroom management may have blocked some of the benefits of student interest, creativity, creation of individualized learning, and the ability to construct answers.

Beyond the need for replication of this research, more in-depth research on increased student performance on questions of higher levels of difficulty is warranted. This future research should continue the focus on standardized test scores, since it is essential to educational policy-making and how America measures success, specific teaching techniques and methodologies, and the teachers' beliefs that accompany them. Since this research found only small differences in overall increases in standardized test scores between the control and only two of the experimental groups, additional research into the types of test questions and why these differences exist are important future research concerns. Additionally, why the control group appeared to have higher increases on low-level questions deserve a second look in spite of the low n's that make these research conclusions uncertain. The methodology used should be open to diverse research methods aligned to the research undertaken and include standards for mixed-method. Definitive and contextual

conclusions, where reasonable and realistic, should predominate. However, generally uniform research definitions agreed upon by the academic communities would provide a basis for clear understanding and a starting point for discussions. This approach may help avoid some of the confusion seen by some researchers while promoting opportunities for choices and innovation. This can also help create classrooms with welcoming and caring environments. As supported in the literature review, research guided by combining teaching methods and standardized test results can assist individualizing education and in the creation of meaningful learning. It can lead to promoting democracy, acceptance of differences, and provide a growing economy based on the creativity and willingness of our students as new members of society to explore not only what is known and accepted but also what might be possible.

APPENDIX 1: Intervention Alignment with Problem-based Learning Theory

Alignment of Intervention with PBL Theory

Theory The Balloon Race

Definition: Use of real-life problem-solving skills in situations that simulate real problems (Jonassen & Land, 2000) that provide complex problem choices with uncertain solution(s), diverse interpretations, and interdisciplinary or interacting systems (Rittel, 1984)	Purpose: To provide quality education to students in a complex problem format that inspires interest, creates opportunity for learning in several disciplines, and has the potential to demonstrate the best skills of each student regardless of their academic standing or economic condition while encouraging individual interest that fosters language enrichment and development, geographic knowledge, mathematics skills, as well as critical thinking.	
Jonassen & Land (2000)		
Learning is a process of meaning making, not of knowledge transmission;	Students are charged with creating their own understanding of facts and events after "flight instruction" and deciding as a class what is needed on an extended hot air balloon adventure through time to acquire ancient artifacts. They must pick up artifacts in chronological order and plan their trip based on the shortest time required to be the first team to finish the race. To do this, along with other extensive requirements, each team will need to coordinate their hot air balloon trip adjusting for both time and distance.	
Contemporary learning theorists focus increasingly on the social nature of this meaning process because humans are social creatures relying on each other for existence and personal beliefs; and	Students are required to work as a team with specific responsibilities assigned and rotated during the two-week assignment. Students will discuss, examine and come to agreement on survival strategies as well as personal beliefs. These ideas are compared to historic ideas and events in their team Flight Logs.	

	A rubric for scoring team responses and cooperation is given to students in their Student Guide and used by the instructor to assess group success.	
The locus of knowledge or meaning is not in the head rather meaning is obtained through culture (Lave& Wenger, 1991) culminating in a requirement that learning environment is holistic, including culture, history, the environment, and other elements such as tools.	Students are required to discuss and compose responses to ancient social problems/events and relate them to the present day. The trips require each team to coordinate knowledge from several different disciplines as well as come to agreement on problem resolution decisions in their own multicultural classroom.	
Essential Characteristics of PBL (Ennis, 1996)		
Emphasize alternatives	The Fate Cards require making choices from potential alternatives for survival, culture, perspectives, and strategies to win the balloon race.	
Emphasize seeking reasons and evidence. Ask, "Why?"	The search for artifacts provide students with opportunities to examine the reasons why things were they way they were then and compare them with the way they are today.	
Emphasize others' point of view and open-mindedness.	The students use Cooperative Learning and the Flight Log Writing assignment required with each landing require team consensus.	
Don't expect students to be subject matter experts.	Students use the Flight Log for creative and individual student interpretation.	
Discuss questions without answers or that are controversial.	Ancient cultures (i.e., The Ancient Olympics) allow discussion on controversial topics, such as discrimination based on sex and even homosexuality. Students learn that some questions do not have right or wrong answers.	
Give time to talk about the answers.	Students discuss and transmit knowledge so that each teammate learns what is being taught.	
Get students to read each other's suggestions. Revise those answers.	The Scribe role responsibility (transcribing the log) for the team, as one	

	example, is given to one student. However, all students have the responsibility to make sure that the finished assignment, the Flight Log, is clear, complete, and accurate. Flight Logs are revised until they are acceptable as outlined by the Flight Log rubric graded by the instructor.	
Seek other devices to revise answers and papers before grading them.	Flight Plans, Flight Logs, and pictures developed by the teams were reviewed by all team members and require the use of multiple sources prior to grading. These other sources include various grade levels of history tests, encyclopedias, the Internet, art books, copies of ancient stories/literature, and picture books. Take-offs every day required an accurate and acceptable plan before liftoff. The instructor using the Flight Plan and Flight Log rubric grades this.	
Provide a set of criteria for judging written responses.	The Rubric Scoring Guide for the Balloon Race provides written criteria for both the Flight Log and Flight Plan.	
Transfer responsibility to students and let them use this in other situations.	Students are expected to transfer the responsibility for teaching each other into every aspect of the classroom as well as before and after school.	

APPENDIX 2: Alignment of the Intervention with 6th Grade Adopted Standards by Discipline

Intervention Alignment to State Standards

6th Grade –Level Expectations (The Missouri Department of Elementary and Secondary Education, March 2, 2004):

Communication Arts

Standard	Intervention
Reading 1. Develop and apply skills and strategies to the reading process…	
(D) Read grade-level instructional text…adjusting reading rate to difficulty and type of text;	Diverse reading level sources are required in the classroom to find factual information for reading, writing and discussion. These include several differing levels of history books, picture and art books, encyclopedias, the classroom text, and the Internet. Students also use subcategories to locate information in outside sources, including the Library. Out-loud group reading required for all instructions, components, assignments, and any source used by the team for Flight Logs or to acquire artifacts, etc. Students search for correct historical resources and read those resources in their teams.
(G) During reading, utilize strategies to self-question, infer, visualize, predict and check;	All teammates participate in writing, editing of assignments. Students using factual sources duplicate artifacts acquired by the teams. Some artistic license is allowed for imagination.
(H) Apply post-reading skills to comprehend and interpret text: question to clarify, reflect, analyze, draw conclusions, summarize, and paraphrase;	Student understanding is reinforced and examined by group negotiation for meaning.

(I) Compare, contrast and analyze, connections between information and relationships in various fiction and non-fiction works, text ideas and own experiences, text ideas and the world by identifying how literature reflects a culture and historic time frame;	Student comprehension and interpreting the text is demonstrated by team creation of a Flight Log for each trip. The Flight Log requires connections between literature, culture, and historic time frame.	
2. Develop and apply skills and strategies to comprehend, analyze and evaluate fiction, poetry and drama from a variety of…	Students examine, analyze, and evaluate poetry from walls and other artifacts from ancient Egypt, Rome, and China from their text, picture books, encyclopedias, and the Internet.	
3. Develop and apply skills and strategies to comprehend, analyze and evaluate nonfiction…	Student comprehension, analysis and evaluation of non-fiction are demonstrated from team-created material developed by the students in their Flight Logs for each of the twelve trips to pick up artifacts.	
(C) Use details from text to…identify problem solving processes and explain the effectiveness of solutions;	Team group discussion of historical outcomes from the text and other resources are used for problem solving needed to complete the race.	
(D) Read and follow multi-step directions to complete a complex task.	The intervention, The Balloon Race, requires students to undertake multi-step processes and completion of complex tasks from their own creation of a 12-trip itinerary. Team acquisition of the artifacts also requires multi-step directions for complex task completion.	
Writing 1. Apply a writing process in composing text…		
(A) Follow writing process to choose and use an appropriate graphic organizer; apply writing process to write effectively in various forms and types of writing.	The Balloon Race requires the initial development of an extensive travel itinerary graphic organizer used as a guide for the race.	
2. Compose well-developed text using standard English conventions…	See the Writing Requirement Rubric for scoring Flight Logs on page 61.	
(B) Use conventions of capitalization in written text…	Teams re-write Flight Logs and Flight Plans until they are correct.	
(C) In composing text, use apostrophe in irregular and plural possessives; quotation marks in dialogue, with assistance.	Teams re-write Flight Logs and Flight Plans until they are correct.	
(D) Use parts of speech correctly in written text including prepositional phases and	Teams re-write Flight Logs and Flight Plans until they are correct.	

appositives;		
(E) In writing, use correct spelling of grade-level frequently used words;	Teams re-write Flight Logs and Flight Plans until they are correct.	
(F) In composing text, use a variety of sentence structures and precise and vivid language.	Teams re-write Flight Logs and Flight Plans until they are correct.	
3. Write effectively in various forms and types of writing…	Teams re-write Flight Logs and Flight Plans until they are correct.	
(A) Write a personal narrative that chronicles a sequence of three or more events and includes sensory detail and dialogue;	Teams compose Flight Logs based on what they see and feel over an extended period of time that may include several related events.	
(C) Write expository and persuasive paragraphs (including cause and effect) with…multi-paragraph essays.	Teams compose Flight Logs that include rationale for team decisions based on what they see, what they have learned, and their Fate Card. Flight Logs are 3-5 paragraphs in length.	
Listening and Speaking 1. Develop and apply effective listening skills and strategies	The Balloon Race requires teams to make a presentation with the acquisition of each artifact. The entire class will be required to stop their activities and listen to each presentation.	
(A) Listen for information, directions, to identify tone, mood and emotion of verb al and nonverbal communication.	Listening by students for information is required for: Instructions for the Balloon Race; Listening and reaction to team discussion; Team out-loud readings from factual sources including the text, encyclopedias, other history books, and selected outside sources students may bring to class.	
Information Literacy 1. Develop and apply effective research process skills to gather, analyze and evaluate information		
(B) Locate and use multiple resources to acquire information, answer questions, and support purpose;	Multiple resources are required to find and document (draw, etc.) artifacts, compose Flight Logs and Flight Plans. Students may find these themselves in a local library or in classroom sources including their text, encyclopedias, other history books, and the Internet.	
(C) Record relevant information using a variety of note-taking and organizational strategies;	Students record information for both the Flight Log and the Flight Plan. Additionally, acquisition of each artifact	

	involves note-taking, duplication of various items of interest and organization of thoughts and processes.	
(D) Define "plagiarism" and document research sources.	Information of plagiarism is included as part of the initial instructions by the teacher and reinforced by giving a "0" when found in student work.	
2. Develop and apply effective skills and strategies to analyze and evaluate oral and visual media	The ability to develop and apply effective skills and strategies for analysis and evaluation of oral and visual media is included in the intervention by the requirement for team presentations of each artifact as it is acquired.	
(A) Identify and explain viewpoints conveyed in various media (e.g., videos, pictures, websites, artwork, plays and/or new programs).	Identifying and explain viewpoints is developed through group negotiation for meaning and importance of team discoveries about the ancient world. Teams must outline or articulate the importance of these findings for today's society. (See Flight Plan Rubric.)	

Mathematics

Standard	Intervention	
Numbers and Operations 3. Compute fluently and make reasonable estimates		
(C) Add and sub tract positive rational numbers	Students are required to compute actual mileage.	
(D) Estimate and justify the results of addition and subtraction of positive rational numbers	Students are required to estimate and justify mileage between extinct boundaries of ancient civilizations. Students use both string and rulers to estimate mileage around geographic barriers such as mountains.	
Geometric and Spatial Relationships 4. Specify locations to describe spatial relationships using coordinate geometry and other representational systems	Students use latitude and longitude to describe locations and estimate locations of ancient civilizations.	
(A) Use coordinates geometry to construct geometric shapes.	Students must choose and construct one of three different models of ancient pyramids and other architectural buildings from the ancient world.	
Measurement 1, Understand measurable attributes of objects and the units, systems and processes of measurement:	Students must compute mileage between ancient locations using both estimates and actual measurement between take-off and landing points.	
(C) Solve problems involving elapsed time (hours and minutes);	Students estimate travel time. Students estimate time elapsed between chronically ordered artifacts.	
2. Apply appropriate techniques, tools, and formulas to determine measurements		
(A) Estimate a measurement using either standard or non-standard unit of measurement;	Students use map mileage scale for standard mileage. Students use a string to estimate parts of a mile. Students are asked to estimate distances between no longer existing ancient civilizations.	
(E) Convert from one unit to another within a system of measurement.	Students convert mileage to travel time, distance between longitudinal lines required by the team's travel itinerary.	
Data and Probability		

1. Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them		
(A) Formulate questions design studies and collect data about a characteristic.	Students obtain artifact acquisitions in chronological order for their travel itinerary.	

Science

Standard	**Intervention**
Scope and Sequence	
Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)	
0. Earth's systems have common components and unique structures	
(A) The earth's crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties;	Students determine food and shelter availability needed for survival for each landing and takeoff. This requires determining fertile and high-density population areas of the ancient world.
(B) The hydrosphere is composed of water, gases and other materials. Students will recognize the properties of water that make it an essential component of the Earth system	Students plan for the water (or liquid) needs of the crew during travel. Students learn the effect of water for long distance travel and for balloon air travel.
5. Earth's systems interact with one another as they undergo change by common processes	
(C) There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates. Students will identify events and landforms created by them…	Students differentiate between mountains and other landforms that will impact team travel plans. Plans must react to changes such as volcanic activity, mountains, over 3,000 feet, etc.
6. Human activity is dependent upon and affects Earth's resources and systems	
(A) Earth's materials are limited natural resources affected by human activity. 0Students will be able to describe the affect of human activities on the quality of water and analyze the ways human affect the erosion and deposition of soil and rock materials.	Students recognize that major civilizations began in areas where water and fertile soil was abundant. Students respond to ancient events that impacted the amount of water (for fishing, crops, building, etc.) and where soil deposits enriched the soil so that crops could grow.
Strand 8: Impact of Science, Technology and Human Activity	
7. Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time.	

(B) Scientific theories are developed based on the body of knowledge and exists at any particular time and must be rigorously questioned and tested for validity. Students will be able to recognize the difficulty science innovators experience as they attempt to break through accepted ideas of their time to reach conclusions that may lead to changes in those ideas and serve to advance scientific understanding and recognize explanations have changed over time as a result of new evidence.	Students respond to the causes of plagues/diseases feared in ancient history and how science responded. Students examine the invention of the parachute by Leonardo DeVinci, the telescope, etc. Students examine the historic development of weapons/architecture/ organization of government/human health care/ and more.

Social Studies

Standard	Intervention
Missouri, United Stars and World History Examine river civilizations including: a) Ancient Egypt and North Africa (pyramids and mathematics); b) India (religions and culture); c) Mesopotamia (beginnings of civilizations); d) China (technological advances).	Students begin the Balloon Race in the fertile river regions of the ancient world and must find and duplicate (or "acquire") in chronological order, artifacts from Egypt and North Africa, India, Mesopotamia, and Chine.
2 SS3 1.9 Distinguish between Greek civilization and the Roman Empire regarding: a) origins of democracy; b) rule of law; c) governmental structures.	Students react and problem-solve by landing in ancient worlds and compare what existed then and what they might expect today.
SS3 1.9 Investigate Europe in the Middle Ages, including: a) the rise of kingdoms; b) feudalism; c) the Crusades.	Student acquisitions of the required artifacts require investigation of the rise of kingdoms, feudalism, and the Crusades.
SS3 1.10 Investigate Feudal Japan, including: a) rise of warlords; b) art.	Student acquisitions of the required artifacts require investigation of Feudal Japan, including the rise of the warlords and art.
SS3 1.10, 1.9 Examine and compare the Mayan, Aztec and Incan cultures	Student acquisition of the required artifacts requires investigation and comparison of the Mayan, Aztec, and Incan cultures.
SS3 1.9 Investigate African Empires, including: a) agriculture, arts, gold production and the trans-Saharan caravan trade b) spread of Islam into Africa.	Student acquisition of the required artifacts require investigation of African Empires and include agriculture, arts, gold production, the trans-Saharan caravan trade and the spread of Islam into Africa.
Economic Concepts and Principles Apply the following economic concepts: a) scarcity, b) supply and demand, c) specialization of regions, nations and individuals (trade), d) trade-offs (opportunity cost0, e) income, wealth and sources of wealth.	Students react/problem-solve to obtain both supplies required for survival on their balloon trip and what would have been available from history at each stage of their travel itinerary. Students also explain why a particular artifact is important.
2 SS4 1.10 Identify the consequences of personal and public economic decisions. Interpret the past, explain the present and predict future consequences of economic decisions.	Students project and defend why these artifacts/events still impact today's societies.

Elements of Geographical Study and Analysis Use geographic research sources to acquire and process information to answer qu4stions and solve problems.	
3 SS5 1.10, 3.2, 1.4, 1.5 Construct maps.	Students use individual maps to create group travel itinerary.
2 SS5 1.8 Locate major cities and nations of the world.	Students use the large classroom geographic map to move their team hot air balloon from one location to another. Students generalize about locations of ancient cites/nations both in the past and in the future based on the past.
1 SS 1.4, 1.5 Locate the world's continents, oceans and major topographic features. SS5 1.4, 1.5 Locate and describe geographic places, using absolute and relative location.	Students use individual, team and the large classroom maps to locate continents, oceans and major topographic features.
2 SS5 1.4, 1.5, 1.10 Describe physical characteristics, such as climate, topography, relationship to water and ecosystems.	Students are able to describe crops, building materials, climate and water and ecosystems materials available upon landing at each destination on their travel itinerary.
1 SS5 1.10 Describe human characteristics, such as people's education, language, diversity, economies, relations, settlement patterns, ethnic background and political systems. Describe trade patterns, explaining how supply and demand influence movement of goods and services, human, natural and capital resources.	Students respond to Fate Cards that require problem resolution on education, language, diversity, economies, relations, settlement patterns, ethnic background and political systems. These responses also examine trade patterns, supply and demand influences and available resources.
2 SS5 1.6 Compare regions and predict how human life in one region in the world would differ from that in another. Describe major patterns of population distribution, demographics and migrations in the world and the impact of these patterns on cultures and community life.	Student team travel itineraries identify population distribution, demographic changes that create patterns on culture and community life.
SS5 1.6 Identify worldwide patterns of resource distribution.	Students identify and react to resources evident in various geographic locations in ancient history and relate these resources to the world today.

1 SS1.10 Identify how technology and culture influence resource use.	Students acquire artifacts created with resources and ancient technology and relate these discoveries to today's world.
2 SS5 1.10 Identify environmental consequences of how people use resources. Identify the effect of natural forces upon human activities. Use geography to interpret the past, explain the present and plan for the future	Students are required by The Balloon Race to identify ancient peoples' use of resources and determine how that impacted human activities both then and now.
Relationships of Individuals and Groups to Institutions and Traditions Evaluate how families, friends, groups and organizations, such as governments, businesses, schools, religious institutions and charities in other cultures, meet the needs of individuals.	
4 SS6 1.6, 1.9 Describe how cultural traditions, human actions and institutions affect people's behavior.	Students use both their text and other sources and include team discussions to describe cultural traditions and human behavior in their Flight Log assignments.
2 SS6 1.6 Identify how personal and group experiences influence people's perceptions and judgment of events. SS6 1.6, 3.5 Describe how ideas, concepts and traditions have changed over time.	Students use both their text and other sources and include team discussions to describe cultural traditions and human behavior in their Flight Log assignments. Students are required to react to ancient events and compare them using today's perspectives.
Tools of Social Science Inquiry	
4 SS7 1.4, 3.5, 1.6 Create maps, graphs, timelines, charts and diagrams to communicate information.	The students use their team travel itinerary and create maps, graphs, and timelines to communicate information.
2 SS7 1.8, 1.4, 2.1 Distinguish between fact and opinion and recognize bias and points of view.	The students use their team discussions and presentations to distinguish between fact and opinion and recognize bias and points of view.
2 SS7 1.7, 3.6, 3.5 Use technological tools for research and presentation.	Students use the Internet and other technology tools for research and presentations.

2-4 SS7 1.4, 2.7, 2.1 Identify, research and defend a point of view/position.	Students use team discussions to identify, research and defend points of view. Students use team presentations to identify, research and defend points of view.
National Geography Standards: (Adapted from the National Council for Social Studies, 2001)	
Standard 1: Uses maps for information and spatial perspective.	Students use team travel maps for information and spatial perspective. Students move their team hot air balloon to each landing location on the classroom geographic map for information and spatial perspective.
Standard 4: Understanding forces of cooperation and conflict that shape Earth's surface	Students understand changes/development of ancient civilization population centers and demonstrate this understanding through the assigned Flight Log.
Standard 5: Understands physical systems that affect human systems.	Students demonstrate their understanding of the physical systems that affect human systems by reacting and problem solving demonstrated in their Flight Logs, team travel itinerary, and drawn Fate Cards.
Standard 6: Can apply geography to Interpret the present and plan for the future.	Students demonstrate their ability to apply geography to interpret the present and plan for the future by their team travel itinerary that requires understanding of geographic patterns to plan for their trip through time and a return to present day.

APPENDIX 3: THE INTERVENTION UNIT PLAN

THE BALLOON RACE

Timeframe for this Lesson: Two to Three Weeks, 55 minutes per day.

Materials Needed:

Colored Pencils

Team Flight Balloon

Student Guide (Attached)

6" piece of string or Ruler

Large (4' x 6' Physical Map of the world, mileage chart) Example (http://education.yahoo.com/reference/factbook/regional_maps/Physi...) below:

"Stick on" Names of Ancient Civilizations

Small world map outline (no countries listed) for each team

Forms for Flight Plan and Flight Log (Shown in Student Guide.)

Large Poster for each Team to List "Found Artifacts"

Fate Cards (List of Cards shown below.)

FATE CARDS TO BE DRAWN BY THE NAVIGATOR ON EACH TEAM UPON LANDING

1. Did you forget to pack a compass? If you did, you must immediately interrupt your planned itinerary and travel to China to purchase this vital piece of equipment.
2. A large blast of wind knocks your balloon off course. If you are traveling over Ancient China, you must land. Gunpowder just blew a hole in your balloon basket. If you are not over

China, it was just a strong gust of wind and you may continue your trip safely.

3. At 200 miles (330 kilometers), your compass began wavering and needed repair. You must land at the nearest city and wait until tomorrow for repairs. File your Flight Log.
4. You encounter seagulls as you fly from land over the ocean. They have torn your balloon and you must make an emergency landing at the city closest to your departure.
5. After you had flown 50 miles (80 kilometers), you encountered a severe sleet storm. You had to land within 50 miles to make repairs.
6. At 100 miles (170 kilometers), a storm came up. You must find a large clearing within 50 miles (80 kilometers) or you must return to your departure and wait until the next day.
7. You arrived safely.
8. Storms are expected near the coastlines. No flying within 100 miles (170 kilometers) of any coastal areas today. Change your course if you are near the coast.
9. This is tornado season. If you are crossing the areas of the map between 40 -45 degrees North and 155-160 degrees West, you are grounded for today. Otherwise, have a safe trip.
10. Your basket buckled as you landed at your destination. You lose half a day making repairs. (You can only go half of your planned trip for today.)
11. Ice forces you to go only half way and land at a civilization nearest your halfway point.
12. Soon after takeoff, a stowaway is found under your provisions. The hijacker produces a gun and forces you to fly toward the Incan Civilization. If you cannot reach the Incan Civilization today, you must fly as far as you can in that direction and land to drop off the hijacker.
13. The Roman government has grounded all balloons for the day while they search for Christians trying to flee persecution. Describe the time and what is happening on the ground in your Pilot's Log.
14. You arrived safely at your destination.
15. A turbulent high wind forces you to fly at an elevation below 500 feet (150 meters). If you had planned to go over mountains today, you must turn back or try to go around them. If there are no mountains in today's flight, land safely at your destination. Remember that mountain passes are all more than 1000 feet in elevation.
16. Heavy rains fall in lowland areas. No flying over marshlands or forests today. Bypass them if you were planning to fly over them.
17. Dust storms are over the dessert areas. If you plan to fly over a desert today, turn back and land at the nearest city or go around the dessert. If there are no deserts in today's flight, you have a safe trip.
18. Fog keeps you from landing at your destination. You must find an alternative land destination.
19. As you try to land, a herdsman on the ground hails you. He warns you not to land because everyone is dying of the Black Death in this area. You must find an alternative-landing destination. Describe your feelings in your Flight Log.
20. Did you forget your telescope? If not, continue your journey. You arrived safely. If you do not have a telescope, go to the nearest Far Eastern Country and purchase one. You and your team lose one turn!
21. Your team is concerned that the Mongols are invading Europe and you decide to warn the European population by dropping leaflets. You need a printing press. What age do you need to be in and where can you go to find a printing press? Take two days to print your leaflets if you are within 100 miles of Europe. If not, forget the printing press and continue your trip as planned.
22. If you are heading into Ancient Europe, you hear the cries of persons being tortured. A local herdsman yells up to your balloon that the Vatican has called for an Inquisition of all those that do not believe in the strict doctrine of the church. If there are any Jews, Muslims, Protestants, or Buddhists on your team, you must find an alternative-landing

destination. Write about this in your Flight Log.

23. The Mongols have taken Ancient Europe. If you were planning to land there, make alternative landing plans. Make note of what impact this will have in your Flight Log.
24. Heavy rains have caused the Nile River to flood. These floodwaters have made it impossible to land in Ancient Egypt. If that was your destination, you must make other destination plans. Does this happen often? Describe this and its impact in your Flight Log.
25. You arrived safely.
26. There is no fuel for your burner. You must delay while you pick up additional wood and new coals. Land where you can find coal.
27. You arrive safely.
28. Strong turbulent winds move over the desert today. No flying is allowed over a desert area. If you are not flying over a desert today, you have a safe flight.
29. An uneventful flight. You landed safely on schedule.
30. By order of the Caesar, Rome has grounded all balloons today for a safety check. Balloons that do not comply will be shot down. If you are going to or leaving Rome, you cannot fly today. Otherwise, have a safe trip.
31. You had sunny skies today. You landed 30 minutes ahead of schedule and had time to visit with the locals. They like you and told you all about what was happening in their area. Write their stories in your Flight Log.
32. North America is heavily fogged in all morning. If you are departing from North America, you may fly only one-half of your planned trip today.
33. The Mayans want your team to play ball with them. You take an extra day out of your travel itinerary to play ball in the Ancient Mayan Civilization. Describe the game and your reaction in your Flight Log.
34. You arrived safely but hear loud popping sounds if you are in Ancient China. Hurry to file a new Flight Plan.
35. Halfway out, your balloon was hit by lightening during a severe storm. You had to set down immediately. This will delay you one day unless you are a Muslim. If you are Muslim, you must land in another area other than Ancient Asia or Ancient Europe because of the danger the Crusades will create for your team. Write about this problem and how you feel about it.
36. You arrive safely.
37. All balloons within 1000 miles (1700 kilometers) of Europe are asked to search for explorers that are either lost or shipwrecked on a boat. If you are in this area, you must land in Ancient Europe. Otherwise, you have a safe trip.

INSTRUCTIONS TO PARTICIPATING TEACHERS

Key instructional and organizational criteria will include the following:

1. This is a culminating unit plan designed to reinforce and add critical thinking for 6th grade students. It is not only open book but students are expected to go beyond their textbook. This can include using any other available resources including other history books (various grade levels), the encyclopedia, picture and art books, and the Internet. If time allows, students may also make trips to the local Library for additional sources. When a student locates a new resource that is relevant to The Balloon Race assignments, he/she is required to bring a copy of that resource back to the team and read it out loud to the entire team. Then, as a team, they will discuss it and determine how to use it for the team's advantage.

2. Students will be told that all team members must fully participate in all required assignments of the race. In spite of the fact that one individual on the team may have been given responsibility for a particular part of the race, every team member has full responsibility for everything the team submits. For example, the assigned "Scribe "on the team has been assigned the responsibility for writing the Flight Log but the entire team must sign off on everything the Scribe writes and must participate by making suggestions, correcting errors, and providing needed support.

3. At any point in the race, the teacher (or the researcher) may approach a team member with a question about any component part or assigned submission during the race. That team member given the question must be able to answer correctly without prompting from other team members. *This means that the team has full responsibility for making sure that every team member has successfully understood what the team is presenting as having been learned.*

4. Students will be purposefully matched in teams of four students by:

   A) Diversity: No team will have only females, members of all one race, or where the team is composed only of students with English as a second language.

   B) Students will be purposefully matched as couples within a team for a) higher and lower proficiency levels for use of native language for non-English speakers as well as English proficiency leadership strengths.

5. After a team has completed the race, individuals in the team will be reassigned to remaining teams until all teams have completed the race. Individuals from the completing teams will be purposefully matched by their demonstrated strength(s) to the needs (demonstrated limitations) of the remaining teams.

6. Students may talk to their own team members in any language they wish at any time during the race. Students will be asked to be silent while instructions are given and when other teams are making presentations.

7. Students are encouraged to use any and all resources available to them in the room. This includes the Internet, the Dictionary, Encyclopedias, and other resources that may have been brought in.

8. Students will move their team's balloon from their place of take-off on the large wall map to their place on landing only after approval of their Flight Log. No team member may touch or move another team's balloon from the wall map.

9. Students will use a team chart to demonstrate the acquisition of each artifact after the instructor has approved it. Each acquisition will be recorded in order of acceptance by the team Scribe.

10. After acquisition and approval, each team will present their completed artifact to the entire class by explain the details of acquisition, timeframe, and any other important details relevant.

11. Students may move about the room but may not talk to any other teams or their individual members during the race.

Objectives of the Lesson

Students will fully understand maps, the geographic relations and locations of ancient world civilizations, and be able to relate events to current needs in the world today. Additionally, they will gain a better understanding of events in world history because they have "observed", discussed, and related these events to their own understanding of how the world should work.

Procedure

Students will use their four person team to form flight teams with specific responsibilities outlined in the Student Guide and prior to "take off". Students will review the physical map, map skills, team "job descriptions", the objects or ancient artifacts (scavenger items listed) needed to win the race and the rules of the simulation.

The race will begin by discussing the job descriptions for each team member.

Next, students will discuss and decide which items need to be carried in the balloon for the trip. The next step is to decide where to land to pick up the needed. Finally, the list of places where you plan to and need to be placed in chronological order based on history, from the early years to the present. The instructor must approve the listing of the places you plan to land because this will determine your team's global route. Suggestions and discussion should continue by the team because some of the artifacts, while differing in appearance, may be present at more than one time in history. So, this means your team must determine the shortest route that you can take and still "pick up" all the artifacts. The game will continue until all teams have "picked up" all items.

Each team will file a daily flight plan prior to "take off". Approval by the instructor is required. Upon landing, each team will file a daily flight log also requiring approval by the instructor. Each plan and each log is worth up to 25 points each and is to be approved by the entire team before submission to the instructor. Upon landing, the navigator will draw a Fate Card from the deck of cards and the team will take action based on the card. Prior to take off each team will outline a preliminary route for their balloon flight. Upon landing, each team will stick their balloon on the large classroom map and note any items picked up on their flight on their team poster so that the entire class can keep track of the status and success of every other team in the classroom. Each flight ends with the team writing the Pilot's Log to detail the history they "saw" on their flight and their observations and feelings about the trip. Documentation of successfully finding artifacts is also required. This is outlined in the Student Guide and may require a picture, research, or drawing before the points can be added for the team.

Assessment

Each team will be given 25 points for each Flight Plan and each Pilot's Log. (See Scoring Guide in Student Guide.) Each pictured items drawn by the team will also add an additional 25 points and must be in color. At the end of the trip, each team will be asked to name the most valuable team player on their team. Each time a student is named, that team member will gain an additional 5 points over and above the team points.

Candy bars will be given to the first flight team to complete their course and pick up all of the items needed for the trip and all of the artifacts.

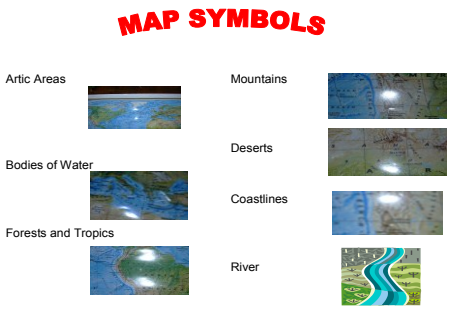
Attached is a copy of the Student Guide that is to be photocopied and given to students for their use throughout the game. Forms in the Student Guide which are to be handed in or posted in the classroom after use need to be duplicated for teach team to use every day.

STUDENT GUIDE HANDOUT

INTRODUCTION

Day 1

Soon you will begin a simulation called The Ancient History Intervention. You and your classmates will pretend you are Balloon travelers and crew in a race across the ancient world to pick of valuable artifacts. Your Balloon travels through time but trips must be made in chronological order except in emergency or to pick up supplies needed for your trip. A map without the ancient civilizations is attached. Your team will need to determine the location of each ancient location. As a class, we will identify the locations on the large classroom maps and they will be identified by their "stick on" names. You will need to land within 200 miles of the name in order to obtain an artifact. Your team will need to draw a picture or duplicate each artifact you obtain and turn it in (for points) with your Flight Log. You will have access to the classroom map and a paper Hot Air Balloon that you need to cut out and decorate as a team. Before you begin, however, your teacher will review map symbols, the scale of distance, and latitude and longitude with you. For your team's use, I have included a list of Map Symbols that will be used most often.



Don't forget, however, that you will need to look at the height of mountains if you plan to fly over them. You cannot fly higher than 3,000 feet!

Now, let's get started. First, please provide the following information on your team:

Name of Team _____

Chairman (Balloon Pilot) _____

Team Navigator _____

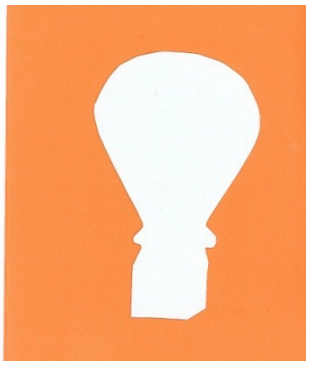
Repair/Materials Coordinator _____

Recorder _____

While every person on your team is expected to participate in all aspects of every decision, each person on your team must accept a specific job. These are permanent positions and will last for the duration of the race. Everyone on your team is expected to participate in all aspects of the decision-making, however, the responsibility to coordinate the ideas and conclusions are determined by your "job". Your teacher will explain the complete responsibilities for each position on your team. However, for additional points, you may want

to write out additional job responsibilities for some job descriptions. These can be added as the game progresses. Additions must be filed with the instructor as they occur.

Next, as a team, you will decide your team colors and decorate your balloon according to your team design. Your team name and class hour must be on your balloon also. A blank copy for your team to cut out and decorate is included below:



Your hot air balloon will be laminated and "adhesive" added when your team is finished. This will allow your team to move your balloon and secure it to the map as you travel the globe.

Next, fill in all of the ancient civilizations we have studied this year on your team map. We will use your team maps to develop the classroom world map at the front of the class. For every correct answer from your team, you will receive 5 points so be prepared.

If you have time, think about items you would need to bring with you on a long balloon trip.

Day 2

Today you will begin to plan your trip. First, list the items that you will need on your trip. Where can you land in the ancient world to obtain these items? Don't forget sand used to slow and land the balloon, the location of food or items that can travel safely without refrigeration. You may take anything that has been invented in the ancient world—such as a compass or binoculars—but you must pick them up as part of your travels. List these items and have your team recorded keep them for reference.

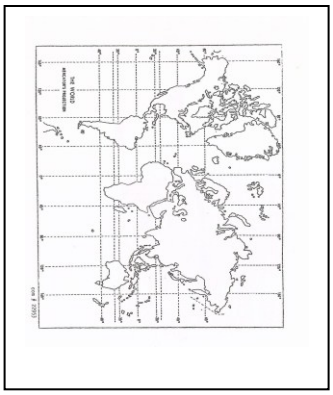
You and your team members must place the following list of ancient artifacts in correct historical order then "land" on the ancient civilization *where* these artifacts are found. In the Library on the computers, research and list the location and dates for the following:

1. A picture of a Pyramid (Hint: There are three possibilities) Create a picture of your pyramid. _____ (Location)_____(Date)
2. Where the Rosetta Stone was found. Explain its importance today. _____ (Location)_____(Date)
3. Lots of Gold (Hint: There are two possibilities). What economic or global impact did this have? _____(Location)_____(Date)
4. Cultivated silk worms. What was the economic or global impact? _____ (Location)_____(Date)
5. Find marshmallows for trade. What impact did this have on the area and on the rest of the world? _____(Location)_____(Date)

6. Visit the shrine considered Islam's holiest place. Draw a picture of it and explain its impact today. _____(Location)_____(Date)
7. A parachute design the really works. Who created it and what else might be important about this person? _____ (Location)_____(Date)
8. An active volcano. _____ (Location) _____(Date)

Your team will need to take the following steps:

1. List the locations and dates of all twelve artifacts. (Where there is more than one choice, you may choose any of the possibilities. Use the one that is best for your team.) Hand this list into the teacher for 25 points for your team.
2. Decide of the global route that will take you to all of the places as quickly as possible. (This is called a "travel itinerary". What is the shortest route? Draw this route on your team map and use it as a graphic organizer for the entire race. Hand it in to the teacher to earn your first 25 points. The World Map (For Team use, this map needs to be expanded to 8 ½ x 11 inches.) that you are to use for this part of your team planning has been included below:



3. Make a list of provisions you will need for your long trip. Each item listed is worth 5 points—but, remember, you must be able to fly—so, no more than 1,000 pounds can be added. This includes the weight of all your team as passengers! Turn in your provisions' list to the teacher.
4. Once all this is completed, you may draw your origination point from the basket with the permission of the teacher. This origination point tells you where you must begin the race. Remember that you have seven ancient artifacts to pick up. This means you will make at least seven trips with a Flight Log and Flight Plan for each trip over the next four days! Good luck!
5. Plagiarism, or copying from any other source without documenting (or referencing) your source is not permitted. You may put ideas in your own words but may not "cut and paste" or copy from another person or source. If you plagiarize, your team will be given a "0" for that component or assignment. If you have questions or do not understand what plagiarism means, please talk to your teacher.

RULES for INTERVENTION

1. All planning outlined in the Student Guide must be completed prior to "take off".
2. You may only travel to one destination each class period. You will be limited to 1,000 miles per day unless you are traveling over the ocean.
3. Your team must file an approved Flight Plan (25 points) with the teacher prior to "take off". It must accurately show your mileage, latitude, and longitude of destination. You may not take off until your Flight Plan is accurate.
4. You must have a parachute on your craft within the first three destinations and SAND (at least 150 pounds) must be included in your provisions within the first two destinations so you can safely land and take off.
5. If you travel to an incorrect destination, you must change your team's initial travel itinerary and include this missed destination.

6. If you are asked for a picture of an item, your team must produce an appropriate drawing on a blank sheet of paper and include this picture with your Flight Log for that trip.
7. At the approval of your Flight Plan for each trip, your Navigator will draw a Fate Card from the teacher's deck of cards that will tell you whether your team has made the destination successfully or whether you have encountered problems that may set you back. You will need to problem-solve as a team for any setbacks that happen due to fate. These must also be included in your Flight Log.
8. At the end of each successful landing, you must file a Flight Log with the teacher before you can take off for your next destination. Flight Logs must include solutions to fat cards as well as a description of what you saw on your trip. This needs to include any appropriate news for the ancient civilizations over which you are flying—vegetation, wildlife, mountains, etc.
9. The "winner" is determined when one team has obtained all twelve items. The game will continue, however, until all teams have finished their flight itinerary. Points will continue to accumulate until all teams have finished. Another winner will be determined from the highest score for all teams.

Flight Logs and Flight Plans

On the next two pages, you will find blank copies of Flight Plan and Flight Log forms. Use these forms to turn in a finished product that has been discussed and approved by your team. A sample Flight Plan might look as follows:

SAMPLE FLIGHT PLAN

Team Name: The High and Mighty Team Colors: Purple and Yellow

City (or Civilization) of Departure Today: Ancient Europe

Approximate Time: 13th Century

City (or Civilization) of Destination Today: Ancient Greece

Today's Total Flight Distance: 1,000 miles

Major Civilizations or Cities Flying Over or Near: Paris, France

Today's Weather Forecast (from newspaper): Fair and Warm

Maximum Elevation for Today's Flight: 10,000 feet

Major Land Areas to be crossed: Europe

Possible problems that could occur: War, Disease, and Wind

Parallels (Latitude Lines) to be crossed: Remaining on 40 degrees North

Meridians (Longitude Lines) to be crossed: 40 degrees East

A sample Flight Log created by your team might read like this:

SAMPLE FLIGHT LOG

Date: June 27, 2005

Team Name: The High and Mighty

Today we had planned to fly from Ancient Europe to Ancient Greece. We expected a peaceful flight over some beautiful terrain. Everything started out fine except we noticed as we left Europe that some of our friends had some blackish spots on their faces. We soon learned that it was the Black Death plague. The whole team had been exposed. We had picked up a stowaway—a large black rat! He really frightened us until we rigged a small parachute and threw him overboard! Europe is not much fun right now. Europeans really need be more concerned about trash control and hygiene.

The weather was satisfactory, however, with only a few high clouds in the sky and a little wind. Our visibility was outstanding. We could see for miles. Then, suddenly, our luck changed and the balloon's compass began wavering. We could not figure out exactly where we were because of the wind so we decided we could probably find Paris due to its size and our extremely good visibility. We plan to pick up parachutes for each team member from Leonardo Di Vinci and have a doctor check the crew for disease.

We landed in a wheat field outside of town, repaired the compass, and then went into Paris for a real meal. We ate fish and chips at the local tavern. Although we could legally drink the ale they offered us, we turned it down because the school would frown on drinking alcohol on a school outing like the balloon trip. Leonardo asked us to spend the night with him in his home and the team plans to take off again first thing tomorrow morning. We did have some good news. The doctor says that no one on our crew has the plague. He did advise us to avoid the Silk Road, however, because the plague is spreading quickly along that route.

Flight Plan

Team Name _____

Team Colors _____ Flight # ____

City of Departure _____

City of Destination _____

Today's Total Flight Distance _____miles

Major Civilizations or Cities Flying Over or Near

_____

Today's Weather Forecast _____

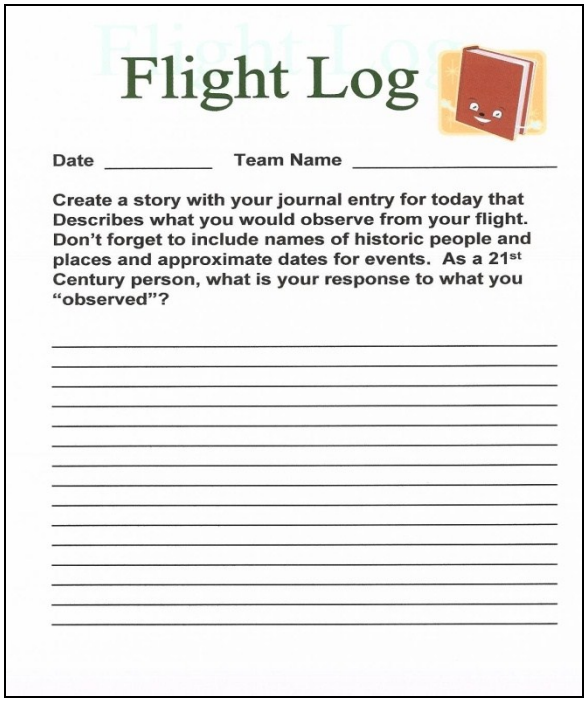
Maximum Elevation for Today's Flight _____

Major Land Areas to be Crossed _____

Problems Expected _____

Parallels (Latitude Lines) to be crossed _____

Meridians (Longitude Lines) to be crossed ___

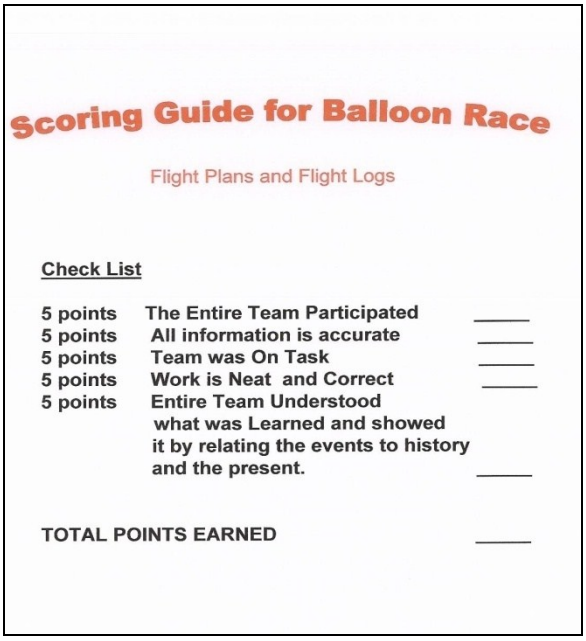


Flight Log

Date _____ Team Name _____

Create a story with your journal entry for today that Describes what you would observe from your flight. Don't forget to include names of historic people and places and approximate dates for events. As a 21st Century person, what is your response to what you "observed"?

The scoring Guide for each Flight Log and each Flight Plan will be posted with your team's work around the room. The Scoring Guide will look like this:



Scoring Guide for Balloon Race

Flight Plans and Flight Logs

Check List

5 points	The Entire Team Participated	_____
5 points	All information is accurate	_____
5 points	Team was On Task	_____
5 points	Work is Neat and Correct	_____
5 points	Entire Team Understood what was Learned and showed it by relating the events to history and the present.	_____
	TOTAL POINTS EARNED	_____

The class-scoring guide for teamwork will be used for each trip your team completes also. In addition, each team member will decide who has been the most helpful team member (or "most valuable player"). Every person who is listed by a team member with a sound reason for nomination will receive an extra five (5) points. The scoring guide is included below:

SCORING GUIDE FOR GROUP WORK

Part I: Definitions and Group Question
2 points Work Neatly Done
2 points Punctuation, Capitalization, Spelling, correct English
3 points Understood what was to be learned
3 points Able to use what was to be learned by relating it to social studies

Part II: Group Work
5 points On task for entire time.
Worked cooperatively with others.
Made an excellent contribution.
4 points On task nearly the entire time.
Worked fairly well with others.
Made a positive contribution.
3 points On task just over half the time.
Had some difficulty working cooperatively with others.
Made a fair contribution.
2 points Off task most of the time.
Had a lot of difficulty working cooperatively with others.
Made a minimal contribution.
1 points Started to work with group.
Had too much difficulty working cooperatively with others.
Made little or no significant contribution.

III. Individual Team Assessment:
Who was the most Helpful (MVP) on your Team this Trip?
Why?

APPENDIX 4: Adopted Standards Aligned to The Intervention

National and State Standards Used by The Balloon Race

6th Grade –Level Expectations (The Missouri Department of Elementary and Secondary Education, March 2, 2004):

Communication Arts

Reading

1. Develop and apply skills and strategies to the reading process…

   (D) Read grade-level instructional text…adjusting reading rate to difficulty and type of text;

   (G) During reading, utilize strategies to self-question, infer, visualize, predict and check…;

   (H) Apply post-reading skills to comprehend and interpret text: question to clarify, reflect, analyze, draw conclusions, summarize, and paraphrase;

   (I) Compare, contrast and analyze, connections between information and relationships in various fiction and non-fiction works, text ideas and own experiences, text ideas and the world by identifying how literature reflects a culture and historic time frame;

2. Develop and apply skills and strategies to comprehend, analyze and evaluate fiction, poetry and drama from a variety of…

   (C) Use details from text to …explain cause and effect identify point of view and mood identify the problem-solving processes of characters and the effectiveness of solutions.

3. Develop and apply skills and strategies to comprehend, analyze and evaluate nonfiction…

   (C) Use details from text to…identify problem solving processes and explain the effectiveness of solutions;

   (D) Read and follow multi-step directions to complete a complex task.

Writing

1. Apply a writing process in composing text…
   (A) Follow a writing process to choose and use an appropriate graphic organizer; apply writing process to write effectively in various forms and types of writing.
2. Compose well-developed text using standard English conventions…
   (B) Use conventions of capitalization in written text…
   (C) In composing text, use apostrophe in irregular and plural possessives; quotation marks in dialogue, with assistance.

(D) Use parts of speech correctly in written text including prepositional phrases and appositives;
(E) In writing, use correct spelling of grade-level frequently used words;
(F) In composing text, use a variety of sentence structures and precise and vivid language.

3. Write effectively in various forms and types of writing…
(A) Write a personal narrative that chronicles a sequence of three or more events and includes sensory detail and dialogue;

(C) Write expository and persuasive paragraphs (including cause and effect) with …multi-paragraph essays.

Listening and Speaking

1. Develop and apply effective listening skills and strategies
(A) Listen for information, directions, to identify tone, mood and emotion of verbal and nonverbal communication.

Information Literacy

1. Develop and apply effective research process skills to gather, analyze and evaluate information
(B) Locate and use multiple resources to acquire information, answer questions, and support purpose;
(C) Record relevant information using a variety of note-taking and organizational strategies;
(D) Define "plagiarism" and document research sources.

2. Develop and apply effective skills and strategies to analyze and evaluate oral and visual media
(A) Identify and explain viewpoints conveyed in various media (e.g., videos, pictures, websites, artwork, plays and/or new programs).

Mathematics

Numbers and Operations

3. Compute fluently and make reasonable estimates

(C) add and subtract positive rational numbers;
(D) estimate and justify the results of addition and subtraction of positive rational numbers.

Geometric and Spatial Relationships

4. Specify locations to describe spatial relationships using coordinate geometry and other representational systems
(A) Use coordinate geometry to construct geometric shapes.

Measurement

1. Understand measurable attributes of objects and the units, systems and processes of measurement:

   (C) solve problems involving elapsed time (hours and minutes);

2. Apply appropriate techniques, tools, and formulas to determine measurements

   (A) Estimate a measurement using either standard or non-standard unit of measurement;
   (E) Convert from one unit to another within a system of measurement.

Data and Probability

1. Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them

   (A) Formulate questions design studies and collect data about a characteristic.

Science

Scope and Sequence

Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

1. Earth's systems have common components and unique structures

   (A) The earth's crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties;

   (B) The hydrosphere is composed of water, gases and other materials. Students will recognize the properties of water that make it an essential component of the Earth system

5. Earth's systems interact with one another as they undergo change by common processes

   (C) There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates. Students will identify events and landforms created by them…

6. Human activity is dependent upon and affects Earth's resources and systems

   (A) Earth's materials are limited natural resources affected by human activity. Students will be able to describe the affect of human activities on the quality of water and analyze the ways humans affect the erosion and deposition of soil and rock materials.

Strand 8: Impact of Science, Technology and Human Activity

7. Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time.
   (B) Scientific theories are developed based on the body of knowledge and exists at any particular time and must be rigorously questioned and tested for validity. Students will be able to recognize the difficulty science innovators experience as they attempt to break through accepted ideas of their time to reach conclusions that may lead to changes in those ideas and serve to advance scientific understanding and recognize explanations have changed over time as a result of new evidence.

Social Studies

Missouri, United States and World History

Examine river civilizations including: a) Ancient Egypt in North Africa (pyramids and mathematics); b) India (religions and culture); c) Mesopotamia (beginnings of civilization); d) China (technological advances).

2 SS3 1.9. Distinguish between Greek civilization and the Roman Empire regarding: a) origins of democracy; b) rule of law; c) governmental structures.
SS3 1.9 Investigate Europe in the Middle Ages, including: a) rise of kingdoms; b) feudalism; c) the Crusades.
SS3 1.10 Investigate Feudal Japan, including: a) rise of war lords; b) art.
SS3 1.10, 1.9 Examine and compare the Mayan, Aztec and Incan cultures.
SS3 1.9 Investigate African Empires, including: a) agriculture, arts, gold production and the trans-Saharan caravan trade b) spread of Islam into Africa.

Economic Concepts and Principles

Apply the following economic concepts: a) scarcity, b) supply and demand, c) specialization of regions, nations and individuals (trade), d) trade-offs (opportunity cost0, e) income, wealth and sources of wealth.

2 SS4 1.10 Identify the consequences of personal and public economic decisions. Interpret the past, explain the present and predict future consequences of economic decisions.

Elements of Geographical Study and Analysis

Use geographic research sources to acquire and process information to answer qu4stions and solve problems.

3 SS5 1.10, 3.2, 1.4, 1.5 Construct maps.

2 SS5 1.8 Locate major cities and nations of the world/

1 SS5 1.4, 1.5 Locate the world's continents, oceans and major topographic features.

SS5 1.4, 1.5 Locate and describe geographic places, using absolute and relative location.

2 SS5 1.4, 1.5, 1.10 Describe physical characteristics, such as climate, topography, relationship to water and ecosystems.

1 SS5 1.10 Describe human characteristics, such as peo0le's education, language, diversity, economies, relations, settlement patterns, ethnic background and political system. Describe trade patterns, explaining how supply and demand influence movement of goods and services, human, natural and capital resources.

2 SS5 1.6 Compare regions and predict how human life in one region in the world would differ from that in another.

Describe major patterns of population distribution, demographics and migrations in the world and the impact of these patterns on cultures and community life.

SS5 1.6 Identify world-wide patterns of resource distribution.

1 SS5 1.10 Identify how technology and culture influence resource use.

2 SS5 1.10 Identify environmental consequences of how people use resources.

Identify the effect of natural forces upon human activities.

Use geography to interpret the past, explain the present and plan for the future.

Relationships of Individuals and Groups to Institutions and Traditions

Evaluate how the needs of individuals are met by families, friends, groups and organizations, such as governments, busin4sses, schools, religious institutions and charities in other cultures.

4 SS6 1.6, 1.9 Describe how cultural traditions, human actins and institutions affect people's behavior.

2 SS6 1.6 Identify how personal and group experiences influence people's perceptions and judgment of events.

SS6 1.6, 3.5 Describe how ideas, concepts and traditions have changed over time.

Tools of Social Science Inquiry

4 SS7 1.4, 3.5, 1.6 Create maps, graphs, timelines, charts and diagrams to communicate information.

2 SS7 1.8, 1.4, 2.1 Distinguish between fact and opinion and recognize bias and points of view.

2 SS7 1.7, 3.6, 3.5 Use technological tools for research and presentation.

2-4 SS7 1.4, 2.7, 2.1 Identify, research and defend a point of view/position.

National Geography Standards:

Standard 1: Uses maps for information and spatial perspective.

Standard 4: Understanding forces of cooperation and conflict that shape Earth's surface.

Standard 5: Understands physical systems that affect human systems.

Standard 6: Can apply geography to interpret the present and plan for the future.
(Adapted from the National Council for Social Studies, 2001)

APPENDIX 5: Survey for Teachers and Students

Research Culmination Survey for Teachers

This survey is very preliminary but basic questions asked will definitely include but not be limited to the following:

1. Did you feel your students were fully engaged during the research timeframe? Why do you feel this way?

2. Do you feel your students increased, more than is typical, their learning during the research timeframe? Use specific examples to explain why or why not.

3. Would you use the intervention unit plan in your regular classroom? Why or why not?

4. Will you use some of the problem-based strategies used by The Balloon Race in your future lesson plans? Why or why not?

5. Are there benefits or drawbacks that you observed during the research timeframe that were not anticipated when you agreed to be part of this study?

6. Other comments? Please feel free to be completely candid?

Research Culmination Survey for Students

1. Have you enjoyed school more/less over the past two weeks? Why?

2. Did you learn more/less/about the same over the past two weeks? Why?

3. What did you learn that was special? Explain.

4. Were there things you feel you should have learned but which you still find confusing? Explain.

5. Are you pleased with the grades you earned over the past two weeks? Why?

6. Do you have any other comments or concerns about the class work you did over the past two weeks?

APPENDIX 6: Interview, Document and Observational Protocols for Students and Teachers

Interview Protocol for Teachers and Students (Creswell, 2003)

GENERAL PROTOCAL FOR OBSERVATIONS

Classrooms will be videotaped with notes taken during and after all interactions with subjects, including both students and teachers. Notes will take the following format:

Date/Time/Class	Descriptive Notes	Reflective Notes
	Demographics	Speculation
	Events	Feelings
		Ideas
		Problems
		Bias?

GENERAL PROTOCAL FOR DOCUMENTS SUCH AS STUDENT WORK

Documents (including student work and rubrics) will be copied with each annotated with:

1. Relevant observations about the rubric/student work
2. Comments with notes as to whether the sources was a primary or secondary

GENERAL PROTOCAL FOR INTERVIEWS

Interviews will be audio taped with opening statements indicating the date, time and with whom. Additionally, the following notations will be included for both teachers and student interviews:

1. Surroundings and environment
2. Subject perspective
3. Process issues or concerns
4. Activity being discussed
5. Strategies for research
6. Social, community, or relationship concerns

Interview Protocol For Teachers

Interviews for teachers will take place after every classroom observation, approximately every fourth day of the research for each classroom. Interview protocols will be coded using qualitative software, QSR NUD*IST. Teachers will be asked to comment and answers will be tape recorded in at least the following areas:

I. Level of student engagement in lesson:

- Teacher observed relevance to students
- Involvement of students

II. Teacher beliefs about PBL:

- Change in perceptions of PBL
- Ease/discomfort with implementation
- Ease/discomfort with classroom environment

III. Student Learning:

- Links to prior knowledge from both measured and unmeasured data
- New Learning from both measured and unmeasured achievement
- Student Interaction/dialog
- Increased understanding and ability to apply learning
- Development of individual student/ entire class higher-level thinking skills
- Observed social/community concerns

IV. Follow-up Questions

Student Interview Protocol

Interviews for students will take place on an as=needed basis depending upon perceived problems, concerns, or superior or different outcomes during the lesson for selected students or groups of students for both the control and intervention classrooms in each district. Interview protocols will be coded using qualitative software, QSR NUD*IST. Identified students will be asked to comment and answers will be tape recorded in at least the following areas:

I. Level of Student Engagement:

   Relevance of Lesson to Student

   Participation/Student dialog

II. Student Knowledge:

   Student understanding and ability to use the information taught

   Student prior knowledge deficits, skills above those anticipated

   Ability to create new knowledge

   Social/community awareness

III. Follow-up Questions

APPENDIX 7: Pre-/Post Test

Pre/Post Test for Comparing Standardized Test Scores from Traditional Classroom Teaching Methods And Problem-Based Learning

Needham Dissertation Data Using The Balloon Race Intervention December 11 – 14, 2009

Students may use both a ruler and calculator for this exam.

Test questions were chosen from the published Test Bank

For Grades 5 - 7 by CTB McGraw-Hill

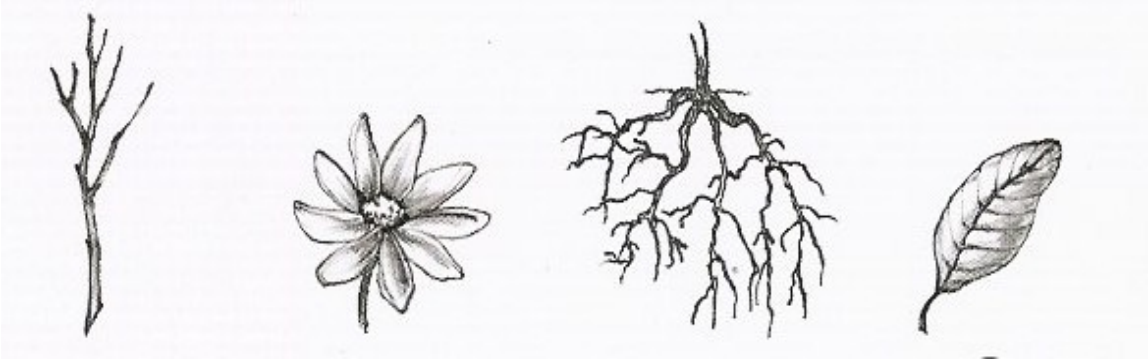
Classroom Connections to TerraNova, The Second Edition

2002

STANDARDIZED TEST

Name _____ # _____

1. Find the phrase containing an underlined word that is not spelled correctly. If all the underlined words are spelled correctly, mark "All correct."
   A. an outstanding student
   B. a flower arrangement
   C. a respectful attitude
   D. All correct
2. Melinda walks her dog 6 times a week. How many times will she walk her dog in 6 weeks?
   A. 12
   B. 35
   C. 36
   D. 42
3. Which picture shows the part of a plant that uses energy from the sun to make its food?



A **B** **C** **D**

4. Which picture shows something that can be used to find the mass of a bone?

A **B** **C** **D**

5. Annie spent $7.00 for two mystery books. One book cost $3.00 more than the other. Which of these is <u>true</u>?

A. The less expensive book cost $1.00.
B. The more expensive book cost less than $4.00.
C. Each book cost more than $3,00.
D. The more expensive book cost $5.00.

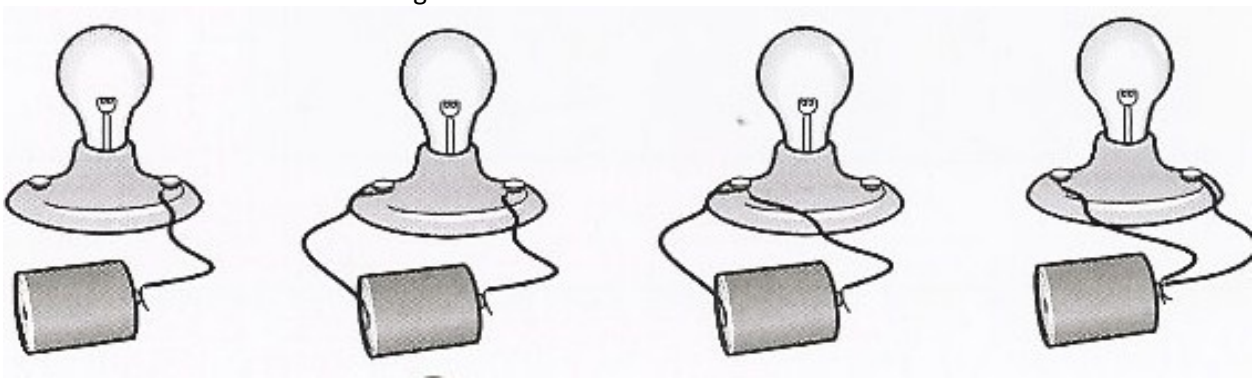
6. Which of these expresses an opinion?

A. Dandelions are found in soil.
B. Dandelions are among the most useful plants in the world.
C. A dandelion is a collection of blossoms.
D. A dandelion head holds about two hundred seeds.

7. Which of these is an example of a chemical change?

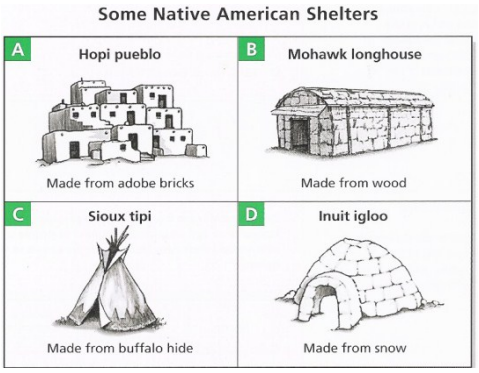
A. a candle burning
B. ice cream melting
C. a puddle evaporating
D. sugar dissolving in water

8. In which of these circuits will the light bulb be lit?



A **B** **C** **D**

9. Use the chart below and your own knowledge to answer the question below the chart.



Which shelter was most likely built in a desert region?

A. Shelter A
B. Shelter B
C. Shelter C
D. Shelter D

10. Choose the sentence that best completes the paragraph below:
Dinah's dream is to become a professional violinist. _____.
Someday she would like to play in an orchestra.

A. She also like soccer and tennis and would like to compete in the Olympics.
B. Children need to pay attention in class and not get lost in dreams.
C. She practices at least an hour every day and never misses her weekly lesson.
D. Orchestras include wind and percussion instruments as well as strings.

11 - 16. DIRECTIONS: Here is a story about the Greek sun god Apollo and his mortal son Phaethon. Read the story. Then answer questions 11- 16.

Apollo and Phaethon

Phaethon wanted to prove to his mortal friends that he really was Apollo's son, so he journeyed east in search of Apollo's golden palace. Apollo welcomed his son and promised to do whatever he could to help him convince his friends. "Tomorrow, let *me* drive the chariot that draws the sun across the sky," Phaethon pleaded. "That will show them!"

Apollo protested. "That is no ordinary chariot or tem of horses. It is too dangerous, my son!"

But Phaethon could not be persuaded. He grasped the reins eagerly, failing to notice how powerful and impatient the horses were. He was thinking only of the looks on his friends' faces. Laughing, he imagined how he would say, "I told you so!" His father's last words were drowned out as thundering hooves propelled the chariot into the sky. "Keep on the middle course, my son, exactly between heaven and Earth!"

The horses took control immediately. Phaethon clung helplessly to the reins, with no hope of steering the chariot as it carried the sun across the sky. The horses galloped wildly off course. Leaping too high, they scorched a long streak in the sky, which became known as the Milky Way. Meanwhile, far below, the two ends of the Earth froze, becoming the North and South Poles. Then, suddenly, the chariot bolted downward.

Deserts were burned into the Earth as the chariot dipped dangerously close.

Finally, Phaethon fell to Earth from the chariot. His body sank to the bottom of a great river. His best friend swam the river, searching hopelessly until Apollo took pity on him and made him a constellation of stars in the sky. That constellation is known as Cygnus, the Swan.

11. Which of these best describes the story "Apollo and Phaethon"?
- A. news report
- B. ancient myth
- C. science article
- D. historical novel

12. The answer you chose for question number 11 is correct because the story includes
- A. a fictional portrait of a famous person
- B. a fanciful explanation of a natural occurrence
- C. an exact measurement of the solar system
- D. an entertaining record of a bitter family quarrel

13. Phaethon's decision to drive the chariot shows that he was
- A. wise
- B. jealous
- C. foolhardy
- D. responsible

14. Phaethon could not be persuaded to change his mind. Find the word that means the same as *persuaded*.
- A. promised
- B. convinced
- C. prevented
- D. allowed

15. According to the story, what was one of the results of Phaethon's ride?
- A. It caused the creation of swans.
- B. It destroyed most of the Earth.
- C. It convinced his friends of his power.
- D. It caused extreme conditions in some places.

16. The Greeks told the story of Phaethon to explain all of these *except:*
- A. the source of the great rivers on Earth
- B. the presence of one of the constellations
- C. why the sun seems to travel across the sky
- D. why the Milky Way galaxy exists

17.

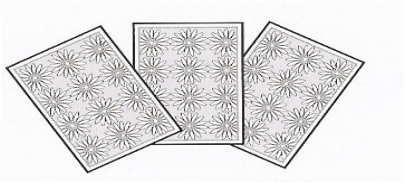
A student rewrote a Greek story about the sun in his own words. There are three mistakes in grammar, capitalization, and punctuation. Draw a line through each part that has a mistake, and write the correction above it.

DAEDALUS AND ICARUS

Daedalus and his son Icarus were prisoners on an island. They're only escape was to fly away over the sea. They made wings of feathers and wax. Daedalus told Icarus not to fly too close to the sun because the wax would melt. Icarus was so excited about flying. That he ignored his father's warning. As he soared higher and higher, the wax holding the feathers melted, and Icarus fell into the sea.

18. A magician held out three different cards. He asked a volunteer to select each of the three cards in any order. How many ways can the cards be selected?

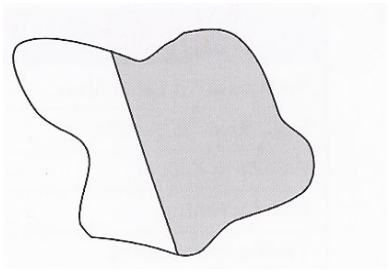
A. 1 way
B. 3 ways
C. 6 ways
D. 12 ways



19. Which number on the sign below is most likely an estimated number?

A. 4
B. 30
C. 12
D. 200

20. At the end of the day, part of a lake is in the shade. Look at the diagram below. The shaded part represents 2.65 square miles.



What is the best estimate of the total area of the lake?

A. 2 square miles
B. 4 square miles
C. 6 square miles
D. 8 square miles

21 -22. DIRECTIONS: The Iditarod Sled Dog Race in Alaska begins in Anchorage and ends in Nome. Questions 21 and 22 are about this race.

21. The Iditarod trail is 1,151 miles long, and there are 26 checkpoints along the way. Estimate the average distance between each of the checkpoints on the trail.

A. 10 miles
B. 40 miles
C. 100 miles
D. 400 miles

22. The chart below shows the distances between the first 6 checkpoints.

Checkpoint Distances	Miles
Anchorage to Eagle River	20
Eagle River to Wasilla	29
Wasilla to Knik	14
Knik to Yentna	52
Yentna to Skwentna	34
Skwentna to Finger Lake	45

The total length of the Iditarod trail is 1,151 miles. What is the distance from Knik to the finish line at Nome?

A. 1,056 miles
B. 1,088 miles
C. 1,102 miles
D. 1,137 miles

23. Tessa is driving from Chesterton to Oak Hill. After driving for 25 miles, she saw the sign below at the junction of two freeways.

Which of these statements must be true?

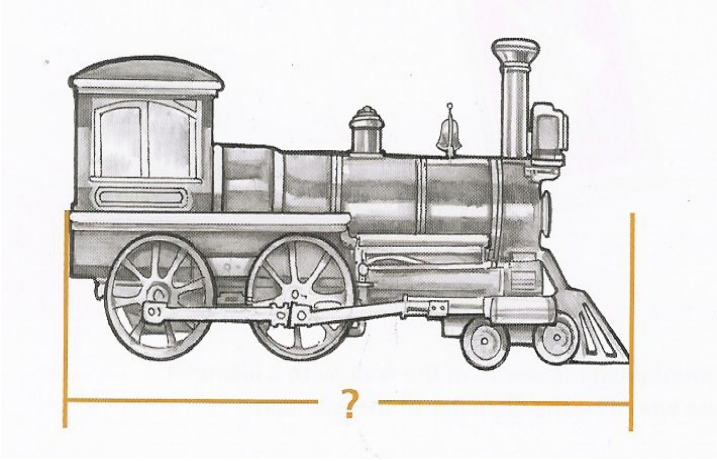
A. Sternville and Oak Hill are 14 miles apart.
B. Sternville is between Chesterton and Oak Hill.
C. Tessa cannot drive to Sternville before going to Oak Hill.
D. The driving distance from Chesterton to Oak Hill is 42 miles.

24. There will be a circular fountain the center of the mall, with a diameter of 40 feet. Which of these would be the diameter of the fountain?

A. the distance around the fountain
B. half the distance around the fountain
C. the distance across the center of the fountain
D. half the distance across the center of the fountain

25. DIRECTIONS: Use the centimeter side of your ruler to help you solve this problem.

Tom's model train is 27.5 centimeters long. The train has an engine and 3 passenger cars. The engine is shown below.



What is the total length of the rest of Tom's model train?

A. 6 centimeters
B. 9.5 centimeters
C. 20 centimeters
D. 27.5 centimeters

26. Sheila tested a laundry soap to see how well it removed black ink stains on white T-shirts. The table below shows the color of the stain after washing one T-shirt in water, and the color of the stain on the other T-shirt after washing it in water with the laundry soap added.

Color of Black Ink Stain After Washing T-Shirts

	None	Light Gray	Medium Gray	Dark Gray	Black
Water Only			✔		
Water with Laundry Soap			✔		

Which of these conclusions can be drawn from the results shown above?

A. Water only did not affect the ink stain.
B. The soap completely removed the ink stain.
C. More stain was removed by the soap than by water.
D. Adding the soap to the water did not help remove the stain.

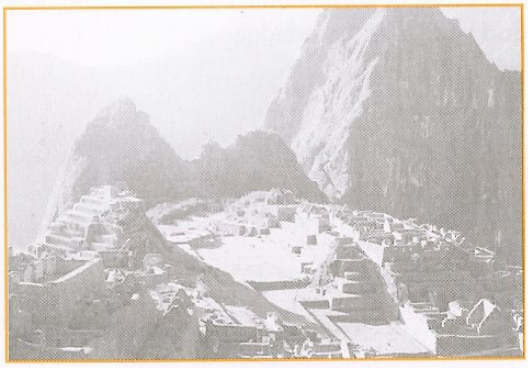
27. Elsa's mother finds that Elsa has a slight fever. Which of these shows the temperature Elsa might have?

A. 88° F
B. 95° F
C. 100° F
D. 110° F

28 – 30.

Machu Picchu

Directions Use the information below and your own knowledge to do Numbers 1 through 3.



The ancient city of Machu Picchu is located high in the mountains of Peru. The remote site contains the ruins of many stone structures, including houses, temples, and ceremonial areas. Although there is evidence that the people of Machu Picchu grew crops on the terraced mountain slopes, little else is known about their lives.

28. According to the information above, which of these statements about Machu Picchu is most likely true?

A. Its location provided protection from invaders.
B. It used large areas of flat land for growing food.
C. Its buildings were made of wood.
D. It was easy for travelers to reach the city.

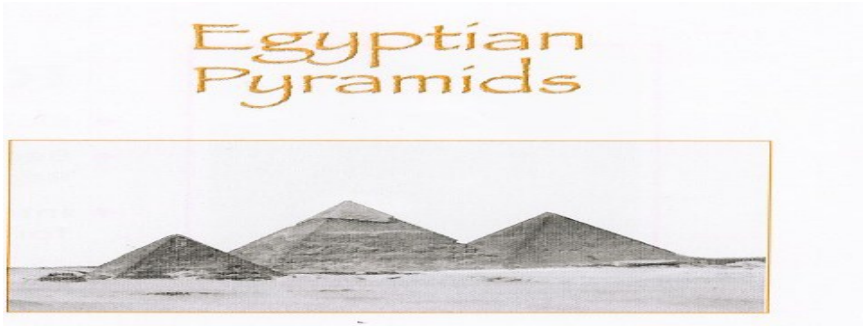
29. The information suggests that the people of Machu Picchu

A. had no knowledge of farming
B. relied on trade for all of their good
C. left detailed written records of their activities
D. practiced some form of religion

30. Which of these civilizations built Machu Picchu?

A. Incan
B. Egyptian
C. Greek
D. Roman

31.

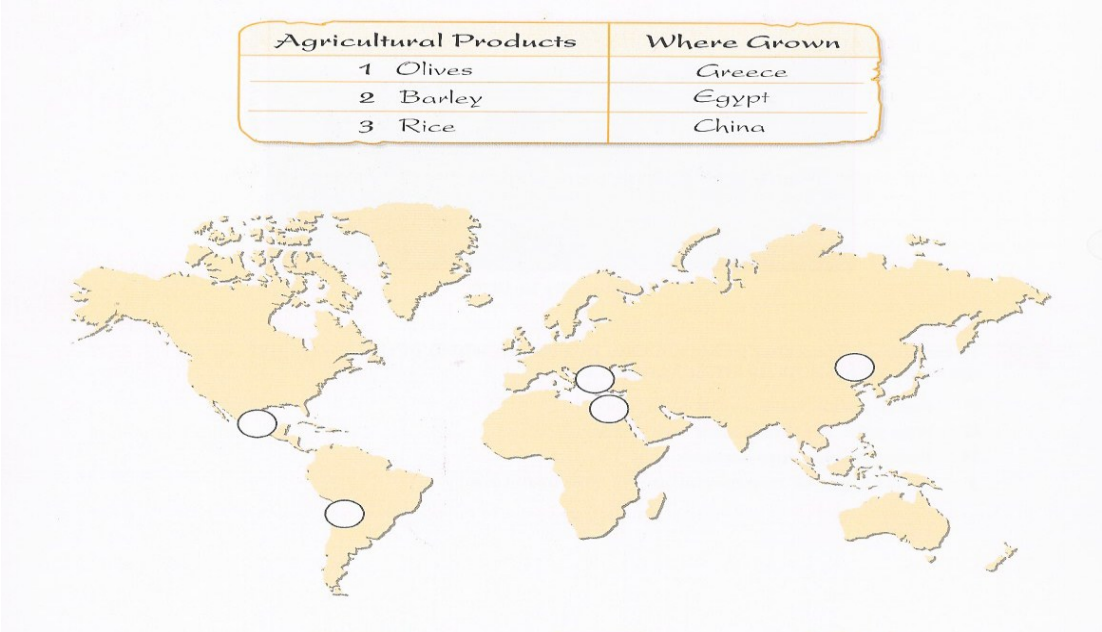


Egyptian pyramids were used mainly as

A. tombs for rulers
B. buildings for storing grain
C. temples for religious practices
D. palaces for the royal family

32. **Agriculture in Ancient Civilizations:** The chart below shows some agricultural products and where they were grown. On the map below, write the number shown for each agricultural product in the circle nearest the location where it was grown.

Agricultural Products	Where Grown
1 Olives	Greece
2 Barley	Egypt
3 Rice	China



33.

Code of Hammurabi

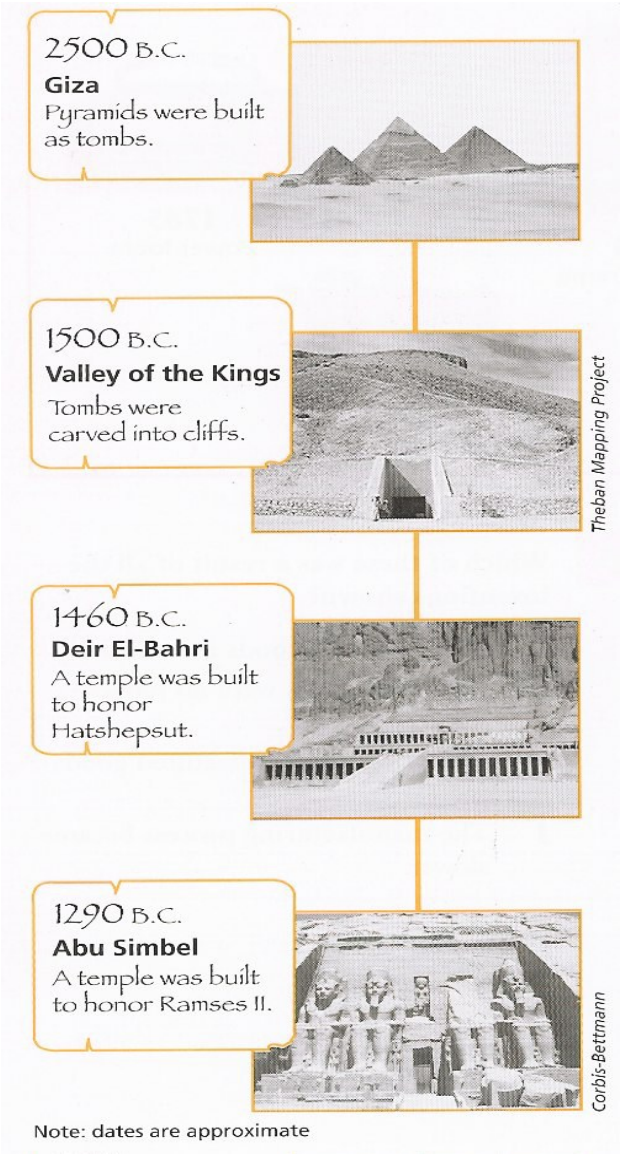
DIRECTIONS: Use the information below and your own knowledge to answer question 33.

The *Code of Hammurabi* was one of the first sets of written laws in history and was established by Hammurabi, the king of Babylon, during his reign from 1792 B.C. to 1750 B.C. The laws were carved onto a stone slab and clearly stated what the violations and punishments were. An example from the Code is given below.

- IF A MAN STOLE EITHER AN OX OR A SHEEP OR A PIG OR A GOAT, IF IT BELONGED TO A TEMPLE OR TO THE STATE, HE SHALL PAY THIRTYFOLD.
- IF IT BELONGED TO ANOTHER MAN, HE SHALL MAKE GOOD TENFOLD.

Before Hammurabi's time, many laws were not written down. Why did Hammurabi most likely think it was important to have written laws? Give one reason.

34. **Ancient Egyptian Monuments**

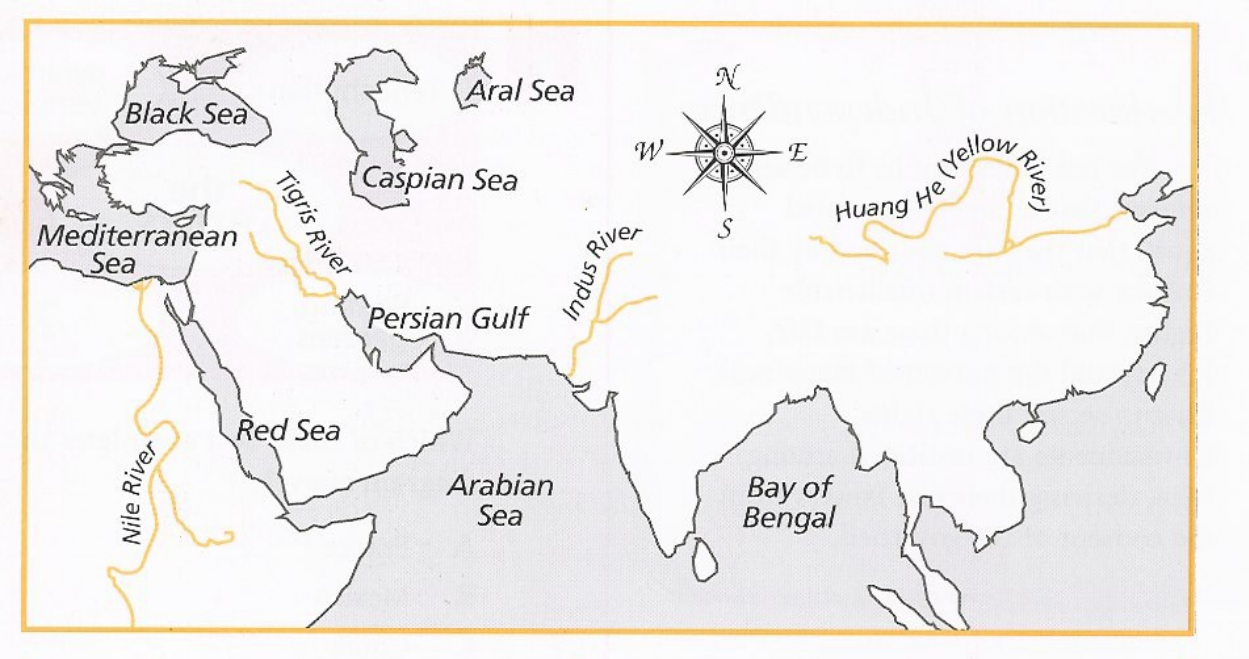


According to the above information, which of these was built first?

A. the pyramids of Giza
B. the temple of Abu Simbel
C. the temple of Deir El-Bahri
D. the tombs of the Valley of the Kings

35 - 37. River Civilizations

DIRECTIONS: The map below shows parts of Africa, Europe, and Asia. Use the map and your own knowledge to do questions 35 – 37.



35.	**Mohenjo-Daro** **Harappa** **Himalayas**

Which of these rivers is most associated with the words listed in the box?

A. Nile
B. Tigris
C. Indus
D. Huang He

36. Near which of these rivers did the ancient Sumerian civilization develop?

A. Nile
B. Tigris
C. Indus
D. Huang He

37. Which of these contributed <u>most</u> to the development of early civilizations in the river areas shown on the map?

A. the rise of city-states
B. a written code of law
C. an organized system of agriculture
D. the invention of cuneiform writing

38. Artifacts Discovered

DIRECTIONS: Use the information below and your own knowledge to do question 38.

Work at a construction site in the city of Westlake has not resumed since pieces of pottery and other artifacts from the 1700s were uncovered. The city council members are reviewing several proposals regarding the artifacts. The proposals are listed below.

Proposals:

- Sell the artifacts and use the money for community services
- Build a museum to house the artifacts
- Place the artifacts in public buildings throughout the community, such as the library and City Hall

Choose one of the proposals. Place a check mark in the box next to the proposal you choose.

- ☐ Sell the artifacts and use the money for community services
- ☐ Build a museum to house the artifacts
- ☐ Place the artifacts in public buildings throughout the community, such as the library and City Hall

Name one advantage of the proposal you selected.

_____

_____

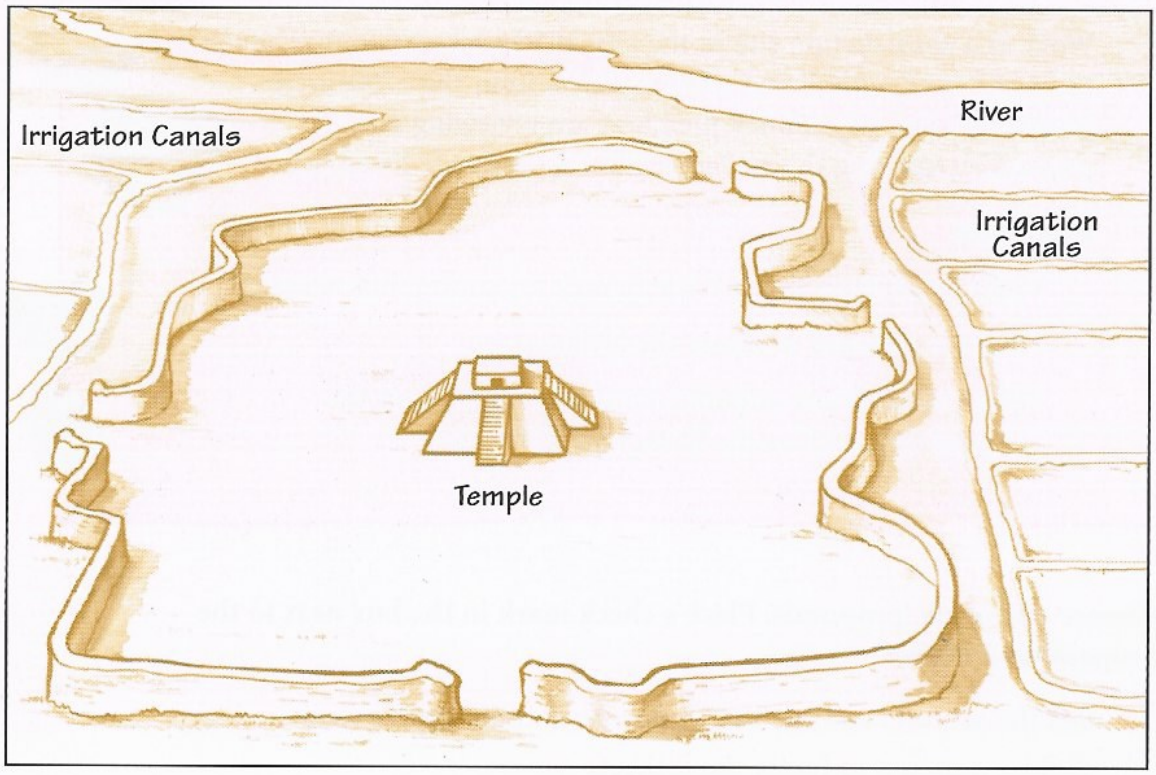
Name one disadvantage of the proposal you selected.

_____

_____

39. Learning About an Ancient City

DIRECTIONS: Use the information below and your own knowledge to do question 39.



Study the drawing of the ruins of an ancient city. Describe two conclusions that can be made about the ancient city and its people. An example has been done for you.

- They probably practiced some form of religion, because they had a temple.
- _____
- _____

40. Economic Issues

DIRECTIONS: Use the information below and your own knowledge to do question 40.

Complete the chart below. Describe one economic effect each event would have on a community.

Event	Effect on a Community
Workers' wages have increased 5% over last year. 	
Attendance at the city zoo continues to decline. 	
A new shopping mall opens for business. 	

I would also like to acknowledge CTB McGraw-Hill again. The Test Bank material was donated for this for this study.

Test questions were chosen from published Test Bank
for Grades 5 - 7 by CTB McGraw-Hill
Classroom Connections to TerraNova, The Second Edition. McGraw-Hill, CTB
2002

APPENDIX 8: Consent from Participants:

Consent from Teachers:

COMPARISON OF STANDARDIZED TEST SCORES FROM TRADITIONAL CLASSROOMS AND THOSE USING PROBLEM-BASED LEARNING

Investigator
This study will be conducted by Elaine Needham, a doctoral candidate in the college of Arts and Sciences at the University of Missouri at Kansas City.

Invitation to Participate
Students and teachers in five classrooms in Missouri urban and suburban school districts are asked to participate.

Purpose
This research will compare the standardized test scores from problem-based learning classrooms with results from traditional classrooms. The research is a mixed method study that will to add to the body of knowledge on why American students are not learning.

Description of Procedures
As a participant, you will be asked to administer a pre- and post-test Classroom Connections exam covering Missouri State standards for 6th grade and allow the researcher to observe/videotape your classroom, consent to tape recorded interviews with you and selected students, and collect student work during the four weeks of the research. The researcher will be in the classroom and available for assistance for half of the research timeframe. Two classes will be observed as traditional classrooms without obstruction or interference while three classrooms will use a problem-based learning process, The Balloon Race, a unit plan developed for 6th grade.

Voluntary Participation
Participation in this study is voluntary. Participants may choose not to participate at all or may refuse to participate in certain activities or answer certain questions, or may discontinue participation at any time. If a teacher participant decides to leave the study the information already provided from the class will be used or destroyed, based on the wishes of the participant.

Fees and Expenses
No fees or expenses will be incurred by participants.

Compensation
Beyond regular teaching salaries, teachers will not be compensated for participation in the study. All materials needed for the study will be donated to teacher classrooms and will include a wall-

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sized geographic map, laminated balloons and the pattern for future use, colored pens, and the printed guide for students in duplicates required for The Balloon Race teams. These materials will be in a form that can be modified and reproduced for future classes by the teacher.

Benefits
Teacher benefits include professional development opportunity, potential to learn/benefit from research observations, and the examination of teaching processes and their potential relationship to student standardized tests scores.

Alternatives to Study Participation
An alternative to study participation is not to participate.

Confidentiality
Participation in this study is strictly confidential. All participants will be described using a numerical identification with classes defined in terms of A_1, A_2, B_1, and B_2 only. Data collected from videotaping will be stored on disc and student work and student Classroom Connections test scores will not contain student names. Tape recordings will be stored unless the participant wishes to claim the tapes of their own interviews after submission of the research results.

While every effort will be made to keep confidential all the information you complete and share, it cannot be absolutely guaranteed. Individuals from the University of Missouri-Kansas City Institutional Review Board (a committee that reviews and approves research studies), Research Protections Program, and Federal regulatory agencies may look at records related to this study for quality improvement and regulatory functions.

In Case of Injury
The University of Missouri-Kansas City appreciates the participation of people who help it carry out its function of developing knowledge through research. If you have any questions about the study that you are participating in you are encouraged to call Elaine Needham, the investigator, at (816) 235-2473 or (816) 216-1182.

Although it is not the University's policy to compensate or provide medical treatment for persons who participate in studies, if you think you have been injured as a result of participating in this study, please call the IRB administrator of UMKV's Social Sciences Institutional Review Board at (816) 235-1764.

Questions
If you have any questions about this study at any time, you may contact Elaine Needham at 5441 Harrison Street, Kansas City, MO, 64110, or you may phone her at either (816) 216-1182 or (816) 235-2473, or email her at ***men998@umkc.edu*** or ***eneedham2004@yahoo.com***.

Authorization
You will be given a copy of this consent form to keep for your records.
Once again, thank you for taking time to participate in this research.

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Printed Name of Participant

Signature of Participant Date

Printed Name of Principal Investigator

Signature of Principal Investigator Date

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Consent 2: Consent from Parents

CONSENT FOR PARENTS FOR PARTICIPATION IN A RESEARCH STUDY

COMPARISON OF STANDARDIZED TEST SCORES FROM TRADITIONAL CLASSROOMS AND THOSE USING PROBLEM-BASED LEARNING

Investigator
This study will be conducted by Elaine Needham, a doctoral candidate in the college of Arts and Sciences, School of Education, at the University of Missouri at Kansas City.

Invitation to Participate
Students and teachers in five classrooms in Missouri urban and suburban school districts will be participating. Your child (or ward) is a part of the selected classrooms. Your child has been asked to participate in the research to help educators better understand the role of a problem-based learning unit of study on standardized test scores. We ask that you read this form and ask any questions you may have before agreeing to allow your child to be in the research. Your child's participation in this research is voluntary. Your decision whether to permit participation will not affect your current or future relations with the University or your child's middle school. If you decide to permit participation, you are free to withdraw your child at any time without affecting that relationship.

Purpose
This research will compare the standardized test scores from problem-based learning classrooms with results from traditional classrooms. The research is a mixed method study that will to add to the body of knowledge on why American students are not learning.

Description of Procedures
As a participant, your child will be asked to

1. Take a pre- and post-MAP based standardized tests using Missouri State standards adopted for 6th grade;
2. Allow the researcher to observe/videotape your child's classroom;
3. Consent to tape recorded interviews with selected students; and
4. Consent to the collection of student work during the four weeks of the research.

The researcher will be in the classroom and available for assistance for half of the research timeframe. Two classes will be observed as traditional classrooms without obstruction or interference while three classrooms will use a problem-based learning process, The Balloon Race, a unit lesson plan developed for 6th grade.

Approximately 160 students will be involved in this research at the University of Missouri-Kansas City from the Raytown School District.

Voluntary Participation

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Participation in this study is voluntary. Participants may choose not to participate at all or may refuse to participate in certain activities or answer certain questions, or may discontinue participation at any time. If a teacher participant decides to leave the study the information already provided from the class will be used or destroyed, based on the wishes of the participant.

Fees and Expenses
No fees or expenses will be incurred by participants.

Compensation
No compensation will be available for participation in the study.

Benefits
Teacher benefits include professional development opportunity, potential to learn/benefit from research observations, and the examination of teaching processes and their potential relationship to student standardized tests scores. Students may benefit from new ideas or knowledge obtained from participation.

Alternatives to Study Participation
An alternative to study participation is not to participate.

Will I be told about new information that may affect my decision to participate?
During the course of the study, you will be informed of any significant new findings (either good or bad), such as changes in the risks or benefits resulting from participation in the research, or new alternatives to participation, that might cause you to change your mind about continuing in the study. If new information is provided to you, your consent to continue to participate in this study will be re-obtained.

Confidentiality
Protected health Information (PHI) is any health information through which you or your child can be identified. PHI is protected by federal law under HIPAA (the Health Insurance Portability and Accountability Act). This study will not involve PHI.

Participation in this study is strictly confidential. The only people who will know that your child is a research subject are members of the research team and your child's teacher. No information about your child, or provided by your child during the research, will be disclosed to others without your written permission, except:

1. if necessary to protect your rights or welfare (for example, the University of Missouri-Kansas City Institutional Review Board monitors the research or consent process); or
2. if required by law.

When the results of the research are published or discussed in conferences, no information will be included that would reveal your child's identity. When pictures or recordings of your child are created for educational purposes, your child's identity will be protected or disguised. Any information that is obtained in connection with this study, and that can be identified with your

child, will remain confidential and will be disclosed only with your permission or as required by law.

Surveys and student work will be scored by your child's regular teacher and the researcher and entered into the researcher's personal computer, by the researcher. This computer is password protected. Student names will be carried only until all data has been collected. This is necessary because assignments need to be matched with subsequent student surveys. As soon as all data has been collated, student names will be eliminated. Further, classes defined in terms of A_1, A_2, B_1, and B_2, etc. only. Data collected from videotaping will be stored on disc and student work and student. Classroom Connections test scores will not contain student names. Tape recordings will be destroyed within three years of research approval unless a parent wishes to claim the tapes of their own child's interview(s) after submission of the research results.

While every effort will be made to keep confidential all the information you complete and share, it cannot be absolutely guaranteed. Individuals from the University of Missouri-Kansas City Institutional Review Board (a committee that reviews and approves research studies), Research Protections Program, and Federal regulatory agencies may look at records related to this study for quality improvement and regulatory functions.

In Case of Injury

The University of Missouri-Kansas City appreciates the participation of people who help it carry out its function of developing knowledge through research. If you have any questions about the study that you are participating in you are encouraged to call Elaine Needham, the investigator, at (816) 235-2473 or (816) 216-1182.

Although it is not the University's policy to compensate or provide medical treatment for persons who participate in studies, if you think you have been injured as a result of participating in this study, please call the IRB administrator of UMKV's Social Sciences Institutional Review Board at (816) 235-1764.

Can I withdraw or be removed from the study?

You can choose whether or permit your child to participate in this study. If you permit your child to participate I this study, you may withdraw him or her at any time without consequences of any kind. Your child also may refuse to answer any questions that he or she does not want to answer and still remain in the study. The investigator may withdraw your child from this research if circumstances arise which warrant doing so.

Questions

If you have any questions about this study at any time or wish to withdraw your child, you may contact Elaine Needham at 5441 Harrison Street, Kansas City, MO, 64110, or you may phone her at either (816) 216-1182 or (816) 235-2473, or email her at ***men998@umkc.edu*** or ***eneedham2004@yahoo.com***.

What are my rights as a research subject?

If you have any questions about your child's rights as a research subject, you may call the Chairperson of the Institutional Review Board at 816-235-1000.

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Authorization

You will be given a copy of this consent form to keep for your records.
Once again, thank you for taking time to participate in this research.

_____
Printed Name of Participant

_____ _____
Signature of Participant Date

_____
Printed Name of Principal Investigator

_____ _____
Signature of Principal Investigator Date

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Consent 3: Consent from Students

CHILD ASSENT FORM FOR
COMPARISON OF STANDARDIZED TEST SCORES FROM TRADITIONAL CLASSROOMS AND THOSE USING PROBLEM-BASED LEARNING

Hello. My name is Elaine Needham. I am a student in the Department of Education at the University of Missouri-Kansas City. I would like to invite you to take part in my research study. A research study is a special way to find out about something. I am trying to learn more about what helps you make better scores on tests.

If you agree to be in this study, you will be asked to meet with me privately and you will be asked to answer questions about why you like certain ways of learning more than other ways. I will be in your class with your friends and your teacher for about three weeks. Sometimes I might tape record or videotape your entire class or, maybe, just you. The questions will be easy to answer. Some of them may be personal—like whether you felt you really understood something or not. We don't know if being in this study will help you score higher on tests or not.

If you agree to help us, your teacher and classmates will not know what you have said unless you say it out loud during regular class time. If you decide to be in the study or if you decide to say "no" your choice will not affect your grades or whether people like you.

When we are done with the study, we will write a report about what we found out. We will not use your name in the report.

Please talk this over with your parents before you decide if you want to be in my study. I will also ask your parents to give their permission for you to be in this study. But even if your parents say yes you can still say no and decide not to be in the study.

If you don't want to be in this study, you don't have to be in it. Remember, being in a study is up to you and no one will be upset if you don't want to be in it. If you decide to stop after we begin that is okay too. Remember that no one else, not even your parents will know what you have told me.

You can ask any question that you have about the study. If you have a question later that you didn't think of now, you can call me or ask your parents, teacher or a friend to call me at 816-235-2473 or at 816-216-1182.

Signing here means that you have read this paper or someone read it to you and that you are willing to be in this study. If you don't want to be in this study, don't sign.

_____ _____
Printed Name of Participant Date

_____
Signature of Participant

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Form Revision Date: 10/13/05

APPENDIX 9: AGREEMENT LETTER REQUEST TO SCHOOL DISTRICT

ELAINE NEEDHAM
5441 Harrison Street
Kansas City, MO 64110
(816) 216-1182
eneedham2004@yahoo.com or men998@umkc.edu

April 27, 2009

Dr. Georgetta May, Principal
Raytown Middle School
4900 Pittman Road
Kansas City, MO 64133

RE: Approval Needed for Problem-based Learning Research
in Two (2) 6th Grade Social Studies Classrooms

Dear Dr. May:

As promised, here is a copy of the Proposal being presented for Committee approval on May 6th. The research outline has already been generally approved. It will need SSIRB approval but will be streamlined by a letter from your district indicating your willingness to participate. North Kansas City and Center Schools have also indicated interest. It would be wonderful to have all three participating.

I am requesting funding to pay for mural-sized laminated geographic maps as well as all instructional materials and the Equity pre- and posttests for all participating classrooms. These materials will remain with the classroom after the research has been completed.

I will need the consent forms included in the Exhibits from the teachers involved, the students, and their parents as well as a letter from you and, hopefully, the Superintendent. If your district has a SSIRB that is separate from UMKC, I will need to obtain approval from that group as well prior to doing the actual research in your classrooms.

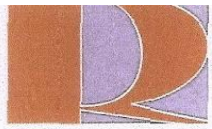
My background includes a Master's in Education and Middle School and High School Certification for Social Studies from the State of Missouri. I have also earned an Education Specialist degree in Curriculum & Instruction and am shooting for May 2010, for my Interdisciplinary Ph.D. in Education, Public Administration, and the Social Science Consortium. I have included my vitae for your perusal.

The Balloon Race is really enjoyable for the students—and—while it cannot be guaranteed—I am hoping they will benefit from the learning opportunities it embraces! It is designed to be an end of the semester assessment and I am hoping we can work together for a target date in the fall. If this is not possible, late in the spring semester will also work.

If I can get an approval letter from you, we can schedule meetings of the teachers. Would it be helpful to meet in person? Or, call me if you have questions or concerns. Thank you again.

Sincerely,
Elaine Needham, End's.

APPENDIX 10: AGREEMENT FROM SCHOOL DISTRICT



6608 Raytown Road • Raytown, MO 64133-5265 • Phone: 816-268-7008 • Fax: 816-268-7019

Office of the Superintendent
allan.markley@raytownschools.org

October 2, 2009

Ms. Elaine Needham
2612 West 47th Ter.
Westwood, KS 66205

Ms. Needham:

I am excited to write a letter of agreement for the Raytown School District to participate in the Needham Dissertation Research, *Comparison of Standardized Test Scores From Traditional Classrooms And Those Using Problem-Based Learning*. The participating school will be Raytown Middle School under the building direction of Principal Dr. Georgetta May. The 6th grade will be involved in using The Balloon Race as a review at the end of the fall semester. I also understand that you will supply printed materials needed for the students, a large geographic map and other items not already found in the classroom but which are required for this research.

I also understand that you plan to work closely with the 6th grade teachers who have agreed to participate to make sure that the overall goals of the district are followed. Students who agree and who have signed consent forms from their parents may also be videotaped during the project data collection. Data collection from participating students will involve copies of student work, pre- and post-tests developed from CTB standardized test banks, and may involve short interviews with students, possibly a few parents, and teachers. Parents will be given copies of tapes that include their child after the study is completed. Students' pre- and post-tests will also be shared and discussed with teachers.

I look forward to seeing the results of the research.

Respectfully,

Dr. Allan Markley
Superintendent

cc: Dr. Steve Shelton, Assistant Superintendent of Secondary Education
Dr. Georgetta May, Principal, Raytown Middle School

www.raytownschools.org

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Recently published works include The Balloon Race: A Method to Increase Student Learning published in April, 2009 in the *Journal of Interdisciplinary Research,* University of Missouri at Kansas City. This is an annual publication of the Interdisciplinary Ph.D. Department. It earned a 3rd Place Award. Elaine Needham has published a number of human-interest articles in her career and had her own column in the Olathe Section of the *Kansas City STAR* for over three years.

Awards and honors include having served as an elected official for the City of Olathe and in various City Management positions early in her career. She also produced the best video documentary (1987), the *Mankatomy Award* for the best amateur television series as Assistant City Manager. This was a program focusing on the accomplishments of the departments of the City of Mankato, Minnesota. She was also a 2000 Kansas City Teaching Fellow**.** This was a cooperative training program for teacher certification through the Kauffman Foundation, Kansas City Missouri School District, and the University of Missouri at Kansas City.

In 2002, Pi Lambda Theta, the International Honor Society and Professional Association in Education accepted Elaine Needham for her academic accomplishments.