THE EFFECTS OF PROJECT BASED LEARNING ON 21ST CENTURY SKILLS AND NO CHILD LEFT BEHIND ACCOUNTABILITY STANDARDS

By

LISA MARIE HOLMES

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF EDUCATION

UNIVERSITY OF FLORIDA

2012

To my mother, Dolores Marie Sauberan, for instilling in me a persistent and resilient work ethic that has allowed me to achieve great things

ACKNOWLEDGMENTS

First I would like to thank Drs. Albert Ritzhaupt and Christopher Sessums for their time and talents as they mentored me through this process. Dr. Sessums pushed me further than I ever thought I could go and Dr. Ritzhaupt guided me to the finish line. I would also like to thank the other members of my committee, Drs. Kara Dawson, Swapna Kumar and Jeanne Repetto. Their thoughtful feedback and encouragement along the way was truly a blessing.

I thank my husband, Leroy Holmes, for this unrelenting love and support as I proceeded through this process. Without his understanding and patience, this journey would have not have been possible.

This dissertation would not have been possible without the camaraderie of my cohort. We endured many trials and successes together and I am honored to call them friends. I would like to specifically acknowledge Douglas Brown and Dr. Mary Edwards for their support. Most of all, I would like to thank Dr. Polly Werner Haldeman. The friendship and affinity we shared along the way proved to be invaluable.

Finally I would like to thank my friends and colleagues. Lewis Rhodes, Olysha Magruder-McRae, Judy Masuda and Matthew Lynch provided me help as sounding boards, editors and cheerleaders. I am eternally grateful for how they have enriched my life professionally and personally. I would like to also like to thank Buddy Kamman, Erica Gindle and Melissa McCallister for their assistance and words of encouragement.

TABLE OF CONTENTS

page

APPENDIX

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

FAIR	Florida Assessments for Instruction in Reading
FCAT	Florida Comprehensive Assessment Test
ISTE	International Society for Technology in Education
NCLB	No Child Left Behind
NMSA	National Middle School Association
PBL	Project Based Learning
SES	Socio-economic Status
ST^2L	Student Tool for Technology Literacy
TDI	Targeted Diagnostic Inventory

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Education

THE EFFECTS OF PROJECT BASED LEARNING ON 21ST CENTURY SKILLS AND NO CHILD LEFT BEHIND ACCOUNTABILITY STANDARDS

By

Lisa Marie Holmes

May 2012

Chair: Albert Ritzhaupt
Major: Curriculum and Instruction

The purpose of this study was to determine ways *Digital Biographies,* a Project Based Learning Unit, developed 21st century skills while simultaneously supporting NCLB accountability standards. The main goal of this study was to inform professional practice by exploring ways to address two separate, seemingly opposing, demands of education in the 21st century: developing important skills students need to be successful in the workforce and addressing the heightened accountability standards of No Child Left Behind. Additional goals include: adding to the research literature examining Project Based Learning's effectiveness and to shed light on ways other teachers can enhance learning opportunities for special populations.

The goal of action research is to develop a certain type of knowledge that focuses on professional practice. To achieve the primary goal of this study, a mixed-methods action research model was used to gather and analyze data from a total of 26 subjects as they participated in a PBL unit. The study group was comprised of 13 students categorized in two or more special populations. The comparison group was comprised of students not identified as belonging to any of the special populations groups.

Standardized assessments, a teacher reflective journal, and rubric scores were analyzed to determine the ways PBL can support both the development of 21st century skills and NCLB accountability standards. A repeated measures analysis of variance (ANOVA) was performed to determine the interaction effect of the standardized assessments. The teacher reflective journal was transcribed and coded to reveal overarching themes. Rubric scores from the teacher researcher and from a validation group were also analyzed.

As evidenced by varied data, *Digital Biographies* proved to support NCLB accountability standards by increasing student achievement in reading and the FCAT success probability rate. It showed promise in developing technology and 21st century skills such as learning and innovation skills and information and technology skills. Additionally, it demonstrated a positive result in terms of closing the technology achievement gap between underserved students and their peers, especially in the area of constructing and demonstrating knowledge. Recommendations for classroom implementation and future research are discussed.

CHAPTER 1
BACKGROUND

Context

As an undergraduate at Slippery Rock University, I studied environmental education. In my early twenties, I was very much an environmentalist and animal rights activist. I wanted to save the world and all the animals in it. I studied environmental education because I thought teaching the next generation to be environmentally conscious and humane to animals was the solution to saving and changing the world. Much of the philosophy of environmental education is rooted in experiential education, "learning by doing". This idea was ingrained in me as a very young educator at Slippery Rock University.

After graduation, I moved to Florida where environmental education was not a certification area like it was in Pennsylvania. Instead, I was certified to teach middle grades science. Shortly thereafter, I accepted a position teaching science at Howard Bishop Middle School in The Academy of Technology and Gifted Studies. I carried the philosophy of learning by doing into the classroom. As a teacher of the gifted, I was required to earn a gifted endorsement. This entailed taking five graduate level courses. As a result, I enrolled in The University of Florida. I earned my master's degree in Special Education with an emphasis in Gifted Education and eventually a specialist's degree in Curriculum and Instruction. While in graduate school, my passion grew for the constructivist learning philosophy deepened. Additionally, I learned about Project-Based Learning (PBL) as a way to differentiate curriculum for gifted learners. This teaching strategy resonated with me due to my exposure to experiential learning at Slippery Rock. I was able to easily incorporate PBL into my science curriculum.

In 2001, The No Child Left Behind Act (NCLB) was passed and with it came higher accountability standards for students and teachers. Suddenly, all teachers were reading teachers. As a science teacher, I had to modify my curriculum to ensure literacy strategies were present throughout. I was incredibly uncomfortable with this role for the first few years; I felt ill-prepared to teach reading. However, with more experience and training I grew more comfortable with this role and was able to find innovative ways to develop literacy strategies within the science curriculum.

Teaching in a technology magnet, I was always required to use technology as a teaching tool. In 2006, our school earned a grant that provided eight laptop carts. This unprecedented access to computers for my students allowed me to more fully integrate technology into the curriculum. This is when my passion for educational technology flourished. My students were able to learn by doing and the laptops were a vehicle that allowed that to happen.

I was ready for a change after 13 years of teaching 6th grade gifted science; but I did not want to leave the magnet or my teaching team. I had the opportunity to switch to social studies. I was able to apply all I learned about technology integration and experimental learning to develop my new curriculum. This was the origin of this study. Since there is not a state test for social studies, history teachers at the school site were expected to provide additional support to language arts teachers in terms of developing students' literacy skills. Considering all factors in my context lead me to my research question: In what ways does *Digital Biographies,* a PBL unit, support the development of 21st century skills of while simultaneously supporting NCLB accountability standards?

Introduction

PBL is a model of instruction that engages students in a sustained investigation that focuses on a centralized question or topic that results in the creation of artifacts demonstrating essential skill and content acquisition (Bransford & Stein, 1993, Thomas, 2000, Blumenfeld et al., 1991). Research indicates that it is valuable tool for learning, especially with underserved populations such as low social-economic status (SES) students (Boaler, 2006, Geier et al., 2008) and students with learning disabilities (Filippatou & Kaidi, 2010). Given the NCLB accountability standards and the focus on 21st century skills, I was interested in exploring how PBL can support both the development of the skills assessed on standardized tests while ensuring 21st century readiness of students that are categorized into two or more of the NCLB subgroups. These subgroups include minorities, free/reduced lunch status, and students with disabilities. To do this, I examined how a technology infused PBL experience effects academic achievement of these students. I also examined how a technology infused PBL experience effects the development of 21st century skills. I compared the academic achievement and skill development of this group of students to a group of students that are not categorized into any of the NCLB subgroups, to determine if technology infused PBL will assist raising all students' achievement level, especially those categorized in the NCLB subgroups. It is hoped that this project will shed light on ways teachers can enhance learning opportunities for underserved populations.

Project Based Learning

As a teacher of the gifted, I have used PBL in the past to enhance and enrich the curriculum to address the specific needs of advanced learners. This method has proven successful as a way to differentiate the curriculum. With the success I have

experienced with PBL in the past, I wondered if I could tailor a PBL unit to address various accountability standards for students that represent two or more of the NCLB subgroups.

There are many ways to describe PBL. Moursund (2002) describes PBL as an instructional approach that is centered on the student as they generate products. Solomon (2003) says, “In PBL, students work in groups to solve challenging problems that are authentic, curriculum- based, and often interdisciplinary” (pg.20). Thomas (2000) states PBL is focused on complex tasks based on challenging questions that students answer through investigative activities that result in a product or presentation. The Buck Institute for Education describes the process as “an extended process of inquiry in response to a complex question, problem or challenge” (The Buck Institute for Education, 2011, “What is PBL,” para. 1). Edutopia describes PBL as “a dynamic approach to teaching in which students explore real-world problems and challenges” (The George Lucas Foundation, 2012, “Project Based Learning,” para. 1).

While there are many ways to describe PBL, there are characteristics of PBL that are commonly accepted as an integral part of the process. They include:

a) Centered on a driving question (Grant, 2002; Blumenfeld et al., 1991; Thomas, 2000).
b) Creation of artifacts (Blumenfeld et al., 1991; Grant, 2002; Bell, 2010).
c) Develops essential skills and concepts.
d) Focus on real life topics (Moursund, 1999; Clark, 2006).
e) Student driven with student freedom (Blumenfeld et al., 1991; Thomas, 2000).

No matter the actual definition is used to describe PBL, there is evidence that PBL works. Diffily (2002) tells us that PBL can be one of the most effective tools a teacher

can utilize to impact learning. Research also demonstrates that PBL can increase academic achievement (Geier et al., 2008; Strobel, J & van Barneveld, A, 2008; Gultekin, 2005; Hernandez- Ramos & De La Paz, 2009; Kucharski, Rust & Ring, 2005).

Driving Forces

There are several forces that define my niche. First is the review of research on PBL published by Thomas (2000). Often cited as a foundational piece describing the research conducted on PBL prior to the year 2000, Thomas recommends several areas for further research. One area in which Thomas recommends further development is evidence of PBL's effectiveness in comparison to traditional methods of instruction. Thomas (2000) discusses how a majority of PBL research focuses on academic achievement and understanding of concepts. While those are important areas on which to concentrate, Thomas called for an increase in the amount of research that looks at other areas where PBL can have an impact. These include development of collaboration and communication skills and ability to problem solve. Thomas suggests multiple measures are needed to assess these areas such as observation, performance tasks and self-reports of students.

Since Thomas' work in 2000, NCLB was signed into law. The law heightened accountability standards; it required that all schools and districts demonstrate that all students progress toward proficiency through the use of standardized assessments (Eisenhart & Towne, 2003). One requirement of NCLB is that schools report standardized assessment results for ten subgroups to ensure no one subgroup is ignored (Eckes & Swando, 2009). The National Center for Fair and Open Testing tells us that there are benefits to this act. Some groups, however, state that a disadvantage to NCLB's tough accountability standards is that schools and teachers feel pressure to

"teach to the test". Teaching to the test is a practice that some feel waters down the curriculum and fails to develop the higher order thinking skills of students.

The year 2000 marked the turn of the 21st century. With the dawn of the 21st century came the need for 21st century skills. The Framework for the 21st Century Learning offers a guideline for the skills students will need in order to be successful in the 21st century workforce. The framework emphasizes core subjects, learning and innovation skills, information, media and technology skills, as well as life and career skills (Partnership for 21st Century Skills, 2011).

Salpeter (2003) tells us that some argue that the accountability demands of NCLB and development of 21st century skills are an either/or choice. Previous International Society for Technology Education (ISTE) president Jan Van Dam states that many districts feel so overwhelmed with accountability demands that they focus more on 20th century skills while sacrificing 21st century skills (Salpeter, 2003). The National Education Association states, "Standardized achievement assessments alone do not generate evidence of the skill sets that the business and education communities believe are necessary to ensure success in the 21st century" (National Education Association, 2010, "Statement of Principle," para.10).

Taking Thomas' recommendation for further research, matched with the accountability standards set forth by NCLB, as well as the professional responsibility I have to prepare my students for the 21st century workforce, defines my niche as a professional and a researcher. Salpeter (2003) quotes Jan Van Dam: "I wholeheartedly agree that there is no need for an either/or approach, there is need for less fear and more creativity applied to the methods used to meet the needs of NCLB" (p. 18). I

proposed that PBL is one such creative method to meet the needs of NCLB, while developing 21st century skills in underserved students. What I hoped to achieve through my research is to contribute to the research base that Thomas called for while determining if PBL is an effective instructional method to satisfy the demands of two somewhat opposing educational schools of thought. To do this I conducted an action research project to examine the effect a PBL experience has on student achievement and development of 21st century skills of students in two or more subgroups.

Subjectivity Statement

I grew up in Buffalo, New York. When I was young, I didn't realize that growing up in this city has influenced every aspect of my life. My values, traditions, and ethics have strong roots in this blue-collar city of hardy, light-hearted individuals. I was the youngest of five, by twelve years. For many reasons, my mother was a single parent for the majority of my life. These circumstances were one of the biggest influences on my young life. My mother accepted a full time job with the telephone company. My mother worked for twenty-five years at this job without taking a single sick day. Twenty-five years of perfect attendance. She modeled a work ethic that I have yet to see in any other individual. My mother taught me the value of working hard and the pride that could be gained from a hard day's work and a job well done that would serve me later in life.

As my older siblings moved out and married, my family's economic status rose. My mother was able to scratch to the lower middle class by the mid 1970s. Neighborhood public schools were not safe, so my mother enrolled me in Catholic school. The K-12 Catholic school experience gave me a firm foundation with its rigorous curriculum but I was never anything more than an average student. The expectation of more was never

set by my teachers who were mostly nuns. I was a compliant student who did just enough to get by and therefore largely flew under the radar at school and at home academically. I was never asked to challenge myself intellectually and was basically content to be an average student. I was bored throughout most of the day with the teacher centered curriculum and never thought of myself as a good student.

I graduated high school somewhere in the middle of my class and starting taking classes at a local community college. For two semesters I earned mediocre grades and worked a part time job. My older brother happened to be attending a small two-year private college in the area. With his encouragement, I transferred and entered the teacher preparation classes. Attending a small school with a brother twelve years my senior proved to be influential as I developed into a life long learner. We developed a sibling rivalry and the competition fueled my desire to do well.

Additionally, for the first time, I was exposed to a different philosophy of teaching. The college I attended employed the Mastery Learning Teaching Technique. For the first time, I was viewed as an individual learner and allowed to progress at my own pace. The focus was on mastering the material, not just covering it. My strong work ethic, flexibility in the coursework, and sibling rivalry caused a shift in my identity as a learner. For the first time in my life I was earning straight A's and B's due to a curriculum that was focused on my learning.

As a junior, I transferred to Slippery Rock University and majored in environmental education. With its roots in experiential learning, this program modeled a learner centered curriculum. I continued to thrive in this type of school environment. I graduated, moved to Florida, and started my teaching profession.

When I began teaching, I was a cognitivist, not for any reason other than I was modeling the style I saw my teachers use as I was growing up. As I learned about differentiation and gained experience, I evolved into a constructionist. I often think back to how a shift in teaching styles changed my attitude as a learner. My entire career, my goal has been to create an environment in my classroom that would be focused on the learner. That is where my interest in PBL and this research comes in.

The road to creating a constructivist classroom has not been an easy one. The NCLB accountability standards proved to be an obstacle to overcome. I felt the curriculum and instructional choices narrowing as NCLB became a bigger and bigger part of my school culture. I will never forget my response the first time an administrator discussed "data driven decision making". I took a stance and said, "I make student driven decisions". My naiveté did not allow me to see that data driven decision making based on standardized assessments was going to become the driving force in my classroom. In order to keep with the demands of the 21st century classroom and support my philosophy of teaching and learning, I was challenged to find a way to meld the two together. These are the circumstances that lead me to this research.

Organization of the Study

This study is organized into six chapters. Each chapter provides important information that serves as the backdrop for this research.

Chapter 2 presents a review of literature that synthesizes my understanding of the role PBL plays in student achievement, the development 21st century Skills, collaboration and technology integration that will show the need for additional research in this area. Chapter 3 outlines the process that was utilized to develop the instructional PBL unit. Chapter 4 outlines the methodology and plans for data analysis. Chapter 5

provides the results. Chapter 6 discusses interpretation of the data and the implications this interpretation has on professional practice.

CHAPTER 2
REVIEW OF LITERATURE

Introduction

The literature review provides background research on PBL, which was essential to inform the development of this study. A goal of this chapter was to define PBL and identify key components that comprise a PBL experience. Additionally, another goal of this chapter was to explore the status of PBL within the context of the 21st century, specifically, on the development of 21st century skills and supporting student achievement as outlined by the No Child Left Behind Act of 2001.

In the new millennium, teachers are charged with balancing the scales between two somewhat conflicting goals in K-12 education. On one side of the scale is NCLB and heightened accountability standards that require students to demonstrate mastery of competency skills through a standardized assessment (Eisenhart & Towne, 2003). NCLB also requires that teachers use methods that are proved effective through scientifically based research (Eisenhart & Towne, 2003). One important standard associated with NCLB is the concept Adequate Yearly Progress (AYP). This is a measure of how well a school is progressing towards making annual progress toward the academic goals set for all students (NCLB, 2002). A central part of AYP is examining and making decisions based on data reported on specific subgroups (Eckes & Swando, 2009). These subgroups include five ethnicity groups, economically disadvantaged, students who are limited English proficient, and students with disabilities (Florida Department of Education, 2002).

On the other side of the scale is The Framework for 21st Century Learning, which offers guidelines for how to prepare students with the skills they will need to be

successful in the 21st century. Some would argue that these two ideas are opposing forces, an either/or choice (Salpeter, 2003). It does not have to be. Salpeter (2003) suggests that creative solutions are needed in order to meet the demands of both areas. One creative solution is offered by Bob Pearlman (2006), who suggests that PBL is a way to marry the demands of developing 21st century skills with the high stakes testing of NCLB. This review examines the existing literature on PLB from the two perspectives of NCLB accountability standards as well as the development of 21st century skills. This review analyzes research that measures the effectiveness of PBL on academic achievement in terms of mixed methods measures such as standardized tests, pre and posttest, interviews and observations. Additionally, this review breaks down if and how PBL supports the development of 21st century skills.

Defining PBL

The concept of Project Based Learning (PBL) is not a new one. This form of experiential learning has deep roots in the constructivist approaches of Dewey (1938), Piaget (1953), Vygotsky (1962), and Bandura (1977). While there is not one sole definition of PBL that exists, several authors and researchers focus on specific components that are inherent in PBL. First, PBL is student focused (Bell, 2010; Newell, 2003). In PBL there is more of an emphasis on the students' learning rather than a prepackaged curriculum (Newell, 2003; Thomas, 2000). Secondly, PBL offers an in-depth examination of complex real life issues or topics (Moursund, 1999; Clark, 2006). Finally, PBL's success derives from the production of authentic, student-created artifacts (Bell, 2010; Clark, 2006; Moursund, 1999). Each of these components and how they are addressed in the literature is provided in this review.

Grant's (2002) research on PBL provides a more in-depth look at common elements that are included in all forms of PBL that offers a deeper understanding of the processes involved in this type of instruction (pg.2):

a) an introduction to "set the stage" or anchor the activity;

b) a task, guiding question or driving question;

c) a process or investigation that results in the creation of one or more sharable artifacts;

d) resources, such as subject-matter experts, textbooks and hypertext links;

e) scaffolding, such as teacher conferences to help learners assess their progress, computer-based questioning and project templates;

f) collaborations, including teams, peer reviews and external content specialists;

g) opportunities for reflection and transfer, such as classroom debriefing sessions,

It is important to know what PBL is and what it is not. Project Based Learning and Problem Based Learning (similar to Project Based Learning and sharing the same acronym) are two different approaches (Thomas, 2000). According to the National Middle School Association (2008), Project Based Learning is student driven and the focus is on the creation of a final product. The process is unclear and the students make decisions through the inquiry process as to how to arrive at the final artifact. The NMSA tells us that in PBL, the focus is on the problem that is specified by the teacher. The focus is on the problem solving and the path students take to solve the problem may differ quite a bit and the final goal is unclear.

Benefits of PBL

There are several benefits to PBL. The George Lucas Educational Foundation states that PBL engages students, reduces absences, improves cooperative learning skills and improves student achievement.

Other benefits of PBL include:

- Improves problem-solving skills (Gallagher, Stepien & Rosenthal, 1992).
- Students have more ownership in the learning process (Boaler, 1997).
- Promotes higher levels of thinking (Mitchell, Foulger, Wetzel & Rathkey, 2008).
- Increases self esteem (Kucharski Rust & Ring, 2005; Thomas, 2000).
- Increases motivation (Grant, 2002).
- PBL accommodates a variety of learning styles (Solomon, 2003).

Benefits of PBL are rather anecdotal. The purpose of this literature review is to find evidence of the benefits of PBL based on empirical research. There is a focus on student achievement and factors that can contribute to student achievement.

Disadvantages of PBL

One must consider the disadvantages of PBL in addition to the benefits. The disadvantages include:

- Limits how much content can be covered in a period (Morsund, 1999).
- Access to technology (Lehman et al., 2006).
- Issues with group dynamics (Lehman et al., 2006, Grant 2002).
- Teachers uncomfortable with their role (Grant, 2002).
- Subjective assessments (Grant, 2002).

Defining 21st Century Skills

The Partnership for 21st Century Skills outlines prepared a report entitled *Learning for the 21st Century.* This report calls for the development of 21st century skill that students today will need for the 21st century workplaces. The report cites that there is "a profound gap between the knowledge and skills most students learn in school and the knowledge and skills they need in a typical 21st century communities and workplace" (p.5). The report goes further to describe a plan for how schools can best prepare students for the challenges of the new century's demands. A major feature of the report is four key elements that focus on student outcomes:

- CORE SUBJECTS. Students should demonstrate a certain level of mastery on the identified core subjects. These core subjects include English, world languages, arts, math, economics, science, geography, history and government and civics.

- LEARNING AND INNOVATION SKILLS. This includes a focus on creative thinking, critical thinking/problem solving and communication and collaboration skills.

- INFORMATION, MEDIA AND TECHNOLOGY SKILLS. Accessing and evaluating information and media.

- LIFE AND CAREER SKILLS. Sub skills of this overarching category include flexibility, self-direction, interpersonal relationships, leadership, managing projects and producing results.

This review analyzes the literature to determine of PBL supports these four elements of student outcomes for the development of 21st century skills.

Literature Search Strategies

The literature review consisted of searches of *Eric Digest, WilsonWeb, Academic Search Premier and JSTOR* using a combination of key word searches of the following terms: Project Based Learning, student achievement, efficacy, learning gains, motivation and engagement. The search was limited by education level to K-12 settings. The time span covered for this literature review is from 2000- present. The year 2000 was chosen because that is the date of the Thomas (2000) Literature Review of PBL. The Thomas review suggests that PBL is a beneficial method of instruction in terms of student achievement but admits the research was limited at that time. Thomas called for more empirical research on PBL. This review looks at the research since Thomas' recommendation. The year 2000 was also chosen as a starting point to review PBL through the lens of the 21st century.

This search resulted in the return of sixteen research studies, as outlined in Table 2-1, from peer-reviewed journals that addressed student achievement or a factor that could contribute to student achievement such as self-efficacy and motivation. Self-

efficacy is a predictor of student achievement (Fenci & Scheel, 2005). Dev (1997) states that increasing student motivation can lead to an increase in academic achievement. Included also are articles that discuss teacher acceptance and factors that effect teacher acceptance of PBL.

Characteristics of Sample Sizes

Sample sizes were categorized into three types. Small sample size n=<30, intermediate sample sizes n=>30<100, and large sample size n=>100. Of the sixteen studies analyzed, six have small sample sizes, five had an intermediate sized sample group, and four had a large sample size. One report did not provide a sample size. The largest sample size represented is 1,921; the smallest sample size represented is five students.

Characteristics of Setting

All the studies were conducted in a K-12 setting, seven in an elementary setting, and six in a middle school setting and three in high school setting. Subject areas represented in the studies included eight science class settings, three history class settings, one multidisciplinary setting, one technology class, and three non-specified settings.

Characteristics of Methods

A variety of methods were utilized in the sixteen research articles reviewed. Only one article relied solely on quantitative methods. The remaining articles used qualitative methods or mixed methods; nine articles use only qualitative methods and six used a mixed methodology.

Components of PBL

As outlined previously, there are three main components constitute a PBL experience. PBL is student-focused; it offers an in-depth examination of a real life issue and requires students to produce artifacts. The following section outlines examples of how each component was addressed in reviewed literature.

Student Centered

Grant (2002) tells us that PBL is a method of instruction that is student centered. Part of the goal of PBL is to increase self directed learning while moving students from being novices to becoming experts in a given area (Baker & White, 2003; Grant & Branch, 2005). Providing students some choice during the PBL experience can tap into student interests and turn learning from a passive act to an active endeavor (Wurdinger, Harr, Hug & Bezon, 2007).

Carr and Jitendra (2000), in their examination of how PBL impacts at risk high school students, employed the eight W's as a guide to maintain the focus on the learners. The 8 W's of Information Inquiry is a model developed early 1990s to address how students navigate their way through information on the internet (Lamb, 1997). The eight steps include watching (exploring), wondering (questioning), webbing (searching), wiggling (evaluating), weaving (synthesizing), wrapping (creating), waving (communicating), and wishing (reflecting) (Carr & Jitendra, 2000). By using this information inquiry model, the researchers placed the onus of processing pertinent information on the students, therefore maintaining the student centered focus.

Baker and White (2003) examined how PBL impacted student attitudes, achievement, and student efficacy in middle school science classrooms. Students were placed in the role of researcher and asked to study how lichens can be a bio-indicator in

an ecosystem. Students were immersed in gathering, analyzing, organizing, and reporting data about lichens density and diversity in their area. This shift from traditional teacher centered activities to students learning is at the essence of student centered learning.

A learner centered classroom should allow student choices to ensure student success (Brown, 2003). Choices can be made by students on topics to study to the types of assignments they decide to do. Choices, even seemingly small choices, can move a student towards being a more autonomous learner (American Psychological Association, 2012).

Kucharski, Rust and Ring (2005) looked at a student centered PBL unit on ecology compared to more traditional methodology in terms of student achievement and satisfaction. In this case, the entire unit was centered on a curriculum called Ecological, Futures and Global Education. Students were allowed to explore a topic within this curriculum. The students also had a choice of whether to study the topic from the perspective of past, present or future. Grant and Branch (2005) provided students with two areas of choice. In a unit exploring human rights, students were given a choice of countries to study. They were also given the option of what kind of artifact they wanted to create, either digital or analog.

Another way to create a learner centered is including content that is relevant to the students (Brown, 1997). Relevant content relates back to students' background knowledge and allows them to address information as it applies to their own community (Maker, 1986). Gultekin (2005) looked at the effects PBL had on learning outcomes. He developed a unit that was student centered by having the students explore

environmental disasters in their homeland of Turkey. In another study, Filippatou and Kaldi (2010), the topic was sea animals due the study location, Greece, where the proximity of the sea made this topic relevant to the learners in this case.

Real Life Issues

PBL learning activities should be anchored by the principle that students learn by focusing on a driving question, in the context of in a real life issue or scenario (Blumenfeld et al., 1991; Gultekin, 2005). Students become more engaged as manipulate their way through real world issues in real world settings (Thomas, 2000). The majority of real life issues represented in this review fall into one of two categories: environmental issues or societal issues. Environmental issues such as pollution (Baker & White, 2003), environmental disasters (Gultekin, 2005), ecological concerns (Kucharski, Rust & Ring, 2005), and destruction of ecosystems and biomes (Mitchell, Foulger & Rathkey, 2009) are featured as real life problems addressed by students. Societal issues are addressed as well. Homelessness (Carr & Jitendra, 2000), human rights (Grant & Branch, 2005), and divergent paths of people throughout history (Hernandez-Ramos & De La Paz, 2009) are such societal issues featured by the research presented here.

Creation of Artifacts

Students demonstrate what they learned while participating in a PBL unit by creating artifacts (Harel & Papert, 1991). Examples of artifacts utilized by researchers in this review include lab reports (Baker & White, 2003), multimedia presentations (Hernandez-Ramos & De La Paz, 2009; Carr & Jitendra, 2000), comic books (Toolin, 2004), web pages (Chan Lin, 2008), and museum like exhibits (Grant & Branch, 2005).

Major Findings

This review suggests that there is evidence that PBL can support the two goals of meeting the accountability standards of NCLB and developing 21st century skills. PBL meets the accountability standards of NCLB since there is evidence that PBL increases student achievement. Provided here is research that shows that PBL also supports factors that contribute to student achievement such as self-efficacy and teacher acceptance. Evidence is also provided that demonstrates that PBL supports the development of 21st century skills. Core subjects are represented in the PBL research offered in this review. This is a key component to developing 21st century skills. This review also shows that PBL encourages collaboration; this too is an important component of developing 21st century skills. Additionally, to develop 21st century skills, technology should be integrated into core subjects. Findings presented here emphasizes that PBL supports technology integration.

PBL and Student Achievement

Hernandez- Ramos and De La Paz (2009) states that "Students in the intervention group demonstrated greater knowledge gains after instruction than students in the contrasting group, thus providing reasons for optimism regarding concerns among teacher and administrators that technology enhanced PBL is not as "effective" as more traditional teaching methods" (pg. 167). They conducted a study comparing PBL as a method of instruction to that of a more traditional methodology. The researchers compared the pretest and posttest scores of 746 students in the intervention group and 771 students in the comparison group. Their research revealed that on a knowledge test, there was a statistically significant difference between the scores of the two groups.

These results are echoed in other research. Gultekin (2005) compared achievement test scores between a study group comprised of 38 students to a control group of 34 students. The researcher used a two sided t- test to determine if there was a difference between the pretest and posttest scores of the two groups. The tests demonstrated that there was a significant correlation between academic success and participation in the PBL intervention.

Other studies have demonstrated a correlation between PBL and student achievement. Moiduser & Betzer (2007) analyzed the pretest and posttest scores on a standardized science and technology exam for both a study group and a control group. The experimental group was comprised of 38 students that demonstrated an increase of 84% between the pre assessment and post assessment while the control group was comprised of 68 students increased 52%.

Additional findings indicate that PBL does support academic achievement (Mitchell, Foulger, Wetzer & Rathkey, 2009; Baker & White, 2003; Panasan & Nuangchalerm, 2010; and Kucharski, Rust & Ring, 2005). Moreover, the research indicates that PBL supports other factors that lead to student success. PBL makes learning enjoyable and creates a positive learning environment (Gultekin, 2005; Chan Lin, 2008). Filippatou & Kaldi (2010) state that motivation is increased through the use of PBL.

Despite research that supports that PBL supports student achievement, due to high stakes testing, teachers do not want to take a risk on an alternate teaching strategy (Colley, 2005). It is hoped that this research not only will inform my own practice but

also enlighten other professional educators as they decide on best practices for improving student achievement.

PBL and Elements of 21st Century Skills

Core subjects

Science was the core subject represented the most in this review of literature (Baker & White, 2003; Panasan & Nuangchalerm, 2010; Lee & Tsai, 2004; Toolin, 2004; Carr & Jitendra, 2000; Chan & Lin, 2008; Filippatou & Kaldi, 2010). This was true in the Thomas (2000) review. History is represented as a core subject in this review as well (Gultekin, 2005; Hernandez-Ramos & De La Paz, 2009). Two major core subjects that are not represented in this review are math and English. These are the two subjects that are testing under the accountability standards of NCLB. This further suggests that perhaps the high stakes testing is a deterrent of utilizing PBL in the classroom.

Collaboration

PBL can be done individually or in groups. This review highlights several research studies where the students were organized in groups (Wurding et al., 2007; Mitchell, Foulger, Wetzer & Rathkey, 2009; Baker & White, 2003; Lam, Cheng & Ma, 2009; Cheng et al., 2008; Hernandez-Ramos & De La Paz, 2009; Moiduser & Betzer, 2007; Chan Lin, 2008). Chan Lin (2008) states that students were able to learn though the cooperative nature of the project and that the students took social responsibility for the group. Hernandez-Ramos and De La Paz (2009) states that students who worked in collaborative PBL groups learned more than their counterparts who received whole group instruction. This evidence suggests that PBL supports the development of the 21st century skill of collaboration. This trend also suggests that PBL in a group may be more effective than in an individual effort. Of the studies that organized students into

groups, only one looked at how the grouping affected student achievement and efficacy. Cheng et al. (2008) looked at group efficacy in a PBL setting when students were organized in heterogeneous and homogeneous groups. This study found that when groups were highly functioning, there was no difference in-group efficacy between the two study groups.

Technology integration

The 21st century is represented in the research though the integration of technology. Seven of the sixteen articles in this review contain some aspect of technology (Lee & Tsai, 2004; Carr & Jitendra, 2000; Chan Lin, 2008; Hernandez-Ramos & De La Paz, 2009; Baker & White, 2003; Grant and Branch, 2005; Moiduser & Betzer, 2007). This evidence suggests that PBL supports the development of Information and Communication Technology Literacies, a 21st century skill. Baker and White (2003) says science students that used technology based maps in a PBL experience had higher Science efficacy than the students that used paper based maps for the same activity. Hernandez-Ramos and De La Paz (2009) documents that students that used technology based PBL had greater learning gains then students that did not. Carr and Jitendra (2000) tell us that PBL that uses technology fosters independence in students.

Rationale for Current Study

PBL shows promise as an effective instructional model for meeting the accountability standards of NCLB while also developing the 21st century skills of students. Research demonstrates that it increases achievement, self-efficacy, and confidence in core subjects and develops technology and group skills. However, this research is somewhat fragmented.

This review does provide limited evidence of increased student achievement through the use of PBL. The majority of the evidence included in this review is based on pretest and posttest scores. Three of the studies provide results of formal standardized assessment as evidence. Additional research that draws on results from standardized tests, such as state assessments or standardized end of the year exams, would deepen the understanding of the effects of PBL on student achievement in terms of NCLB.

The majority of the studies offered in this review examine the impact PBL has on student achievement based on a relatively short experience. Most of the studies look at the impact of PBL over the course of a single unit or learning center covering only a couple of weeks. The research base would benefit from the addition of studies that look at the effects of PBL on student achievement when it is implemented in the long term, possibly over the entire course of a school year or semester.

The core subject of science is represented in this review with minimal studies featuring history and other subjects. Future researchers should look at PBL in the context of a variety of core subjects as outlined by the 21st Century Skills Framework. There is a great need for research involving math and English since those are the subjects that are tested under the NCLB accountability standards and there is little research on PBL in those areas. This research would deepen our understanding of how PBL can impact student achievement in the high stakes testing that is required by NCLB.

The research presented in this review demonstrates that collaboration and cooperative learning is a hallmark of PBL. What is missing is research that highlights

the role grouping play in PBL. Is it the nature of PBL that causes students to achieve or is it the cooperative learning aspects that lend itself to student achievement? A recommendation for future research is to look at student achievement as student participates in a group PBL experience as compared to a solo PBL experience. This research would too provide evidence of how PBL impacts the development of collaboration skills.

Conclusion

Hill and Hannafin (2001) suggest that using PBL conflicts with NCLB accountability standards that values breadth of information over depth. However, this review demonstrates evidence that it is possible to go deep into topics through PBL while still obtaining student achievement. This review also demonstrates that PBL supports the development of 21st century skills. Overall, the literature included in this review provides evidence that PBL is an appropriate approach for meeting the demands of NCLB while also developing the 21st century skills of students. However, additional research is needed to solidify this argument.

Table 2-1. PBL articles featured in literature review.

Study	N	Methods	Examples	Subject	Grade	Findings
Baker & White (2003)	n= 93 n= 99	Mixed Methods	Pre/post test Self efficacy survey	Science	8th	GIS (technology/PBL) group had a positive improvement in science efficacy and attitudes towards computers compared to those that used paper maps.
Carr & Jitendra (2000)	n=9	Qualitative	Interviews Case Studies	Science	10th	PBL increased price, self-growth, confidence, self esteem and responsibility.
Chan Lin (2008)	n= N/A	Qualitative	Interviews Field notes	Science	5th	PBL created a positive learning environment.
Cheng et al. (2008)	n=1921	Mixed Methods	Exam Grades Questioning	N/A	6th-8th	Group heterogeneity in PBL was not a determining factor in efficacy.
Filippatou & Kaldi (2010)	n=24	Mixed Methods	Pre/post tests Case Study	Science	4th	LD students gained benefits from PBL in terms of academic performance, motivation and group work.
Grant & Branch (2005)	n=5	Qualitative	Case study Interviews Inventories Observation	History	8th	PBL created artifacts demonstrated some individual abilities while other abilities went untapped.
Gultekin (2005)	n=20 n=20	Mixed Methods	Pre/post test Interview	History	5th	PBL improves academic success, makes learning enjoyable and develops essential skills.
Hernandez-Ramos & De La Paz (2009)	n=100 n= 70	Mixed Methods	Pre/post test Survey	History	8th	PBL students showed greater gains in knowledge and enhanced historical thinking.

Table 2-1. Continued

Study	N	Methods	Examples	Subject	Grade	Findings
Kucharski, Rust & Ring (2005)	n = 461	Mixed Methods	Terra Nova Scores Survey	NA	1st-6th	Some students showed higher achievement gains in PBL. Greater teacher and student satisfaction in PBL environment.
Lam & Tsai (2009)	n= 631	Qualitative	Questionnaires Interview	Multidisciplinary	6th 7th & 8th	Teacher motivation was a predictor of student motivation in PBL.
Lee & Tsai (2004)	n= 156	Qualitative	Assessment Scales	Science	5th	There was a difference in learning styles and learning transfer in PBL situations.
Mioduser & Betzer (2008)	n= 60 n=60	Mixed Methods	Exams Survey	Tech	High school	PBL groups had a significant increase in achievement compared to non PBL group.
Mitchell, Foulger & Rathkey (2009)	n=1 classroom	Qualitative	Field notes Interviews Observations Case Study	Science	1st	Teacher was able to negotiate a project based learning situation while attending to the standards.
Panasan & Nuangchalerm (2010)	n=44 n=44	Quantitative	Pre/Post Test	Science	5th	PBL and Inquiry method had the same academic achievement results.
Toolin (2004)	n=6	Qualitative	Observations Collection of Artifacts	Science	Middle and High School	There are factors that predict a teachers adoption and acceptance of PBL.
Wurding et al. (2007)	n= 35	Qualitative	Surveys Interviews	NA	Middle School	Teacher acceptance influenced how students were engaged.

CHAPTER 3
DEVELOPMENT OF THE DIGITAL BIOGRAPHIES UNIT

Introduction

As outlined in previous chapter, meeting the demands of developing a curriculum differentiated to meet the needs of gifted learners, while developing 21st century skills and meeting the accountability standards of NCLB, proved to be a felt difficulty in my professional practice. Traditionally, each demand was addressed separately. I had my daily lessons in my history class, which were driven by the state standards. School wide, we had specific weekly lessons that content area teachers used to address literacy skills and NCLB accountability standards. Finally, there were specific activities and classes to develop 21st century and technology skills. I felt pulled in many different directions. I began to wonder if there was a way to address all demands simultaneously.

Demands

At the time of the study, I taught 6th grade gifted world history. As a history teacher, I was responsible for teaching and assessing benchmarks and standards that are set forth by the State of Florida in The Sunshine State Standards. An overview of my course is described by Florida Department of Education,

> SIXTH GRADE: M/J WORLD HISTORY ADVANCED: The sixth grade social studies curriculum consists of the following content area strands: world history, geography, civics, and economics. The primary content for this course pertains to the world's earliest civilizations to the ancient and classical civilizations of Africa, Asia, and Europe. Students will be exposed to the multiple dynamics of world history including economics, geography, politics, and religion/philosophy. Students will study methods of historical inquiry and primary and secondary historical documents.
>
> HONORS/ADVANCED: Courses offer scaffolded learning opportunities for students to develop the critical skills of analysis, synthesis, and evaluation in a more rigorous and reflective academic setting. Students are

> empowered to perform at higher levels as they engage in the following: analyzing historical documents and supplementary readings, working in the context of thematically categorized information, becoming proficient in note-taking, participating in Socratic seminars/discussions, emphasizing free-response and document-based writing, contrasting opposing viewpoints, solving problems, etc. Students will develop and demonstrate their skills through participation in a capstone and/or extended research-based paper/project (e.g., history fair, participatory citizenship project, mock congressional hearing, projects for competitive evaluation, investment portfolio contests, or other teacher-directed projects (Florida Department of Education, 2008).

Like all teachers, I was also faced with the tough accountability standards of NCLB. All teachers at my school site, regardless of content area, were required to collect, monitor, and make decisions based on students' reading data. One important standard associated with NCLB is the clear demonstration that the school is making Adequate Yearly Progress. Adequate Yearly Progress (AYP) is a measure of how well a school is progressing towards making annual progress toward the academic goals set for all students in the state (NCLB, 2002). While I focus on all students' success, at my school site we concentrated on the progress of students in three specific subgroups: minority, low socio-economic status, and students with disabilities. For the purpose of this study these subgroups are identified as "special populations". The accountability standards of NCLB demand that students in each of these special populations make sufficient learning gains (Eckes & Swando, 2009). Students who are categorized into two or three of these special populations are of special concern. At the school level, data on these students are carefully scrutinized and decisions are made based on this data. This data provides information for the school in terms of placement, but also provides classroom teachers valuable information. Classroom teachers differentiate the curriculum for individual students based on the information revealed by the data. The Florida Department of Education was selected by the United States Department of

Education to participate in the Differentiated Accountability Model for school improvement (Bureau of School Improvement, 2006). Under this model, school improvement plans are individualized for each school based on the specific needs and concern of the school. In line with the goals of the Florida Differentiated Accountability Model, there are specific literacy goals that are set forth for our school based on benchmark and state standardized testing results and each teacher is required to incorporate lessons into their content area to reinforce the literacy goals (Bureau of School Improvement, 2006).

The Florida Department of Education has the mission of developing 21st century skills so that students can use technology to develop higher order thinking skills to make them competitive in a global community. As a teacher, it is my responsibility to prepare students for the 21st century by developing these skills. The Framework for the 21st Century Learning offers a guideline for the skills students will need in order to be successful in the 21st century workforce. The framework calls for the emphasis on 21st century topics and tools. These include the use of 21st century content, context, technology tools, as well as information, reasoning, and productivity skills. This is magnified due to the fact that I teach in a technology magnet program that is built around using 21st century technology to develop these skills by infusing them into the content area.

The Maker Model calls for differentiation of curriculum to meet the needs of gifted learners. Maker (1986) calls for modification to learning environment, content, process, and product in order to meet the needs of gifted learners. Since early in my career, I have successfully used PBL to differentiate in terms of environment, content, process,

and product to enhance and enrich the curriculum for gifted learners. This, paired with Pearlman's (2008) suggestion that PBL was an effective way of marrying the demands of developing 21st century skills with preparing students for high stakes testing, was the impetus of my study. I decided to carefully examine the ways a teacher created PBL unit could support the development of 21st century skills of while simultaneously supporting NCLB accountability standards.

Inspiration for the Unit

Once I decided to use a PBL unit, the next step was to decide the direction the PBL unit would take. I considered several incarnations of a PBL unit. I thought of developing a Web Quest that addressed standards on ancient religions; an interdisciplinary team unit based on a novel about a young boy that climbs Mount Everest; and a unit that utilized historical fiction and literature circles. The final unit I developed called *Digital Biographies* was inspired by the combination of three different elements that merged into one.

The first element that inspired this unit was a mini art project I worked on, in conjunction with the technology teacher, each year during Black History Month. As part of the Black History Month festivities, students studied several influential African Americans and the contributions they made to society. In history class, we also studied the history of Mount Rushmore. As a culminating event, students used technology tools to create a Mount Rushmore-like monument commemorating four of the influential African Americans we studied. While I enjoyed the creative part of this project and how it celebrated Black History Month, I always wanted to more fully develop this project. As a history teacher, I liked the idea of students exploring the concept of monuments how

they can reflect what a society value but I was not sure how to best infuse this into my curriculum.

Additionally, I was awarded a *Foundation for Success* grant. The Alachua County Public Schools Foundation (2009) states "these grants are awarded to teachers to implement creative programs to address an area of concern in their school with the ultimate goal of improving student achievement" (Alachua County Public Schools Foundation,2009, "Foundations for Success," para 2). I wrote the grant to purchase biographies to use as part of my gifted history curriculum. Biographies can provide a perspective that allows students to understand history by connecting intellectually with individuals from the past (Fertig, 2008). Kilgore (2001) says that biographies are especially important genre for gifted students since they "frequently serve as role models for gifted students by illustrating how even prominent or successful people experienced triumphs, failures, and hardships throughout their lives" (pg. 31).

Since March is Woman's History Month, I decided to purchase biographies of influential women from history with the funds from this grant. With the assistance of the media specialists and the language arts teacher on my team, I selected a variety of texts that would be appropriate for a range of reading levels. The titles, authors and Lexile score for each book can be found in Table 3-1. When I first purchased these biographies, I did not have a clear vision of how to most effectively use them in my class. It wasn't until I began planning for this study that I decided to incorporate them into a PBL unit.

The final inspiration came from a workshop I attended in 2009: *World Heritage Sites: A Global Education Workshop.* World Heritage Sites are specific places in the

world selected by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as places that meet a certain criteria as special cultural or physical significance. To be considered, the site must have outstanding universal value and meet at least one of ten criteria. These criteria include:

- to represent a masterpiece of human creative genius;
- to exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;
- to bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;
- to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;
- to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change
- to be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.
- to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
- to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;
- to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;
- to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

That same school year, I used the World Heritage Sites and the criteria to enrich a lesson about the Seven Wonders of the Ancient World. I noted during this lesson that

the students were fascinated by the selection process and the criteria that a site must meet to earn this designation. I knew at some point I wanted to more fully develop a series of lessons focusing on these sites. One of the ten includes the site "exhibiting an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town planning or landscape design" (UNESCO, 2008). This criterion, paired with the Mount Rushmore project, seemed to go hand in hand.

After pondering several different ideas, I decided to meld these three ideas together to form a PBL Unit entitled *Digital Biographies*. This unit involved students reading a biography of an influential woman and then working with a small group to create a proposal and model for a monument to commemorate her accomplishments using criterion similar to that of the World Heritage Sites.

Planning the Unit

With my topic in place, the next step was to start planning the elements of the unit. To ensure I was including all the essential elements of a strong PBL unit, I referred to the features outlined by Grant (2002) as outlined by the previous chapter. The first step I took was to develop the driving question. The Buck Institute (2010) tells us that the driving question is the guides the project for both the teacher and the students. After careful consideration, I was able to develop the driving question for the unit: How do we create a memorial to honor an influential woman from history?

With the driving question in place, I was able to address the other features Grant (2002) outlines as important elements of a PBL unit and develop lesson plans. The key features of the unit I developed are outlined in Table 3-3. The lesson plans are provided in Appendix A.

I utilized a rubric developed by Elkire (2007) to ensure the lessons I was creating addressed the development of 21st century skills. A critical group of colleagues used the same rubric, as well as one developed by The Buck Institute, to assess how well the lesson plans incorporated these features. Elkire's (2007) rubric can be found in Appendix E.

Implementation of the Unit

As outlined in the lesson plans, the unit is divided into three main phases. The first phase was the introduction phase. This is where I introduced the biographies to the students. The second phase was an independent phase where students were responsible for reading their assigned biography and completing assignments. The final stage is where the students worked in small groups to plan their monument and presentation.

Phase One

Phase one served as the introduction to the unit. A whole class discussion behind the meaning of Black History Month and Women's History Month set the stage for the rest of the unit. This discussion topic was appropriate since the timing of this introduction coincided with the end of Black History Month and the start of Women's History Month. After the whole class discussion, I organized the students into small groups. The groups were arranged by using the students' Lexile scores to assign each student a biography that was appropriate for his or her Lexile range. At this time, I also identified the study group as well as the comparision group for this study. The study group was comprised of the students in my classes that were categorized in two or more of the special populations that were of special concern at my school site. The study group consisted of thirteen students. The comparison group was identified by

randomly selecting thirteen students that were not categorized into any of the special populations.

Once arranged in their small groups, I introduced the biographies. I provided each group with a copy of the biography they were assigned to read. The first activities were designed to unlock previous knowledge. First, I had each group predict what each woman was famous for based solely on the cover of the book. Most of the groups had a general idea of what each woman did based on her name, title of the book, and cover artwork. Additionally, I had each group read just the back jacket of the book to get a glimpse into what they were going to read about. Each group then completed a portion of a *Know, Want to Know and Learned* (KWL) graphic organizer. A KWL is a tool to use to unlock previous knowledge while having students question what they are about to read to increase engagement (Ogle, 2009). After reading the book jacket the students participated in a small group discussion to complete the K and W column of their graphic organizer. Figure 3-1 depicts a sample of a K and W column from a graphic organizer about Pocahontas. Some of the questions were crossed out at the end the unit to indicate the things the students learned from reading the biography.

At the time, I noted that the background knowledge the students possessed was very superficial. The K column in the sample in Figure 3-1 demonstrates that. A quote from my teacher journal also echoes this thought.

> March 3 Reflection Journal Entry - All groups knew bits and pieces about all the biographies. Noted- that they overall didn't have a lot of background knowledge. There was very superficial knowledge.
>
> March 3 Reflection Journal Entry - The "know" column in the KWL is a little sparse. This confirms that the choices for the biographies were good ones and appropriate for the readers.

Based on the my journal, I noted that while the background knowledge was superficial, many of the groups were able to develop open ended, thought provoking questions for the W column. Evidence of this can be found in my teacher journal and also in student sample provided in Figure 3-1.

> March 3 Reflection Journal Entry - What they wanted to know, about half of the questions were superficial and half were open ended thoughtful questions. “Was her life troubled? What struggles did she have?”

Evidence of student engagement is documented with the teacher journal and the KWL lists the groups created. We would later return to the KWL lists as a culminating activity to document how much they learned throughout the unit.

Phase Two

Phase two of the unit involved the students independently reading their assigned biography. They had four weeks to complete the reading and complete a vocabulary assignment each week. The assignments, called *Post-it Note Vocab,* required students to use post-it notes to identify new or challenging words while they are reading the biography. Later, they predicted the meaning of the words using context clues and eventually defined the word using a dictionary. Using context clues to predict word meaning was area of weakness based on school-wide data. As part of our school’s literacy plan we were required to build in lessons to practice this skill. During the first week, I modeled the reading strategy for the students and had them engage in guided practice in their small groups. For the weeks that followed, students completed the assignment on their own and turned it in on the due date.

I noted during the first week the assignment was due that there was a noticeable difference in the completion rates between the study group and the comparison group. As documented in my teacher journal, of the thirteen students that were in the study

group, one student handed their assignment in on time, eight students handed in the assignment late while four never completed the assignment. This was not the case with the comparison group. With the comparison group, nine handed the assignment in on time, three handed the assignment in late and one did not hand it in at all. The low return rate of the special populations group concerned me so I pondered a possible solution for the following week.

I did some brainstorming with three other teachers on my team to determine why the return rate was so low for the special population group. We also discussed possible solutions. Based on our discussion we were able to determine that the students were in fact reading their biographies. The other teachers noted they saw the students reading them during our team's Silent Sustained Reading (SSR) time. This is documented in my teacher journal.

> March 8 Teacher Journal –It was that during SSR time, several students pulled out their biography. They seem very motivated.

Since they were motivated to read, I needed to motivate them to complete the assignment. The language arts teacher on my team said that she did an illustrated vocabulary activity with her classes that was effective in motivating students to focus on the vocabulary words. The activity consisted of picking two vocabulary words and illustrating a forced association. She said the creative nature of this activity seemed to provide motivation for students. The following week, I told the students we were going to participate in this activity based on the vocabulary from their biographies. However, in order to be able to participate, they needed to have their vocabulary assignment complete on the due date. Any students that did not complete the assignment had to work on this assignment while the other students participated in the activity.

The following week the return rate on the vocabulary homework improved. From the study group, eleven students turned the assignment on time, one late and one not at all. The comparison group had ten students turn the assignment on time, one late and two not at all.

The forced association vocabulary activity involved students picking a word from their personal vocabulary list they completed and also picking a word from a classmate's that read a different biography and create an illustration. One example of an illustration included the word *raptor* from the Carson biography and the word *ailing* from the Keller biography. The student created an illustration of an eagle on crutches to illustrate an *ailing raptor*. The image the student created demonstrated that they had a grasp on the proper definition of both of the words.

The final assignment was due during the fourth week. This was the final week blocked out for independent reading. Students created a timeline that consisted of at least ten important events from the biography. The creation of this time lime provided evidence that the student had completed reading the biography assigned to them. Every student in both groups successfully completed a timeline and thus demonstrated they were ready to move on to the next phase of the unit.

Phase Three

The next phase of the unit focused on the development of the monument. I used the Martin Luther King monument, which was under construction at the time of the study, to guide the initial instruction. During a whole class discussion we identified reasons why King was deserving of a monument. We also analyzed the rationale of the location of the monument. I outlined that this monument is located in *The Line of Leadership*, which aligns this monument with the Jefferson Memorial and the Lincoln

Memorial. Many of the students identified that King also delivered his famous “I have a dream speech” on the steps of the Lincoln Memorial. Additionally, we also discussed the inspiration for the design for this monument comes from a quote in that speech, “Out of the mountain of despair, a stone of hope”. Students quickly made the association that the monument resembled a mountain, with the piece containing the image of MLK carved out of it, the stone. At this point, I saw their interest piqued. They started asking me about the design rational behind other famous monuments. Several did not understand why the Washington Monument was simply a “huge tower”. They did not see the rationale behind this design. This proved to me they were really processing the idea of design. Once I explained that the Washington Monument was an obelisk, an ancient symbol of power, they understood the design.

The students were then reassembled into their small groups and I distributed the outline for the project. A copy of the assignment can be found in Appendix F. In the small groups, the students discussed their task. They started brainstorming and negotiating who was going to be responsible for what. Evidence from my teacher journal documents how different groups went about deciding who was going to do what.

> April 5 Teacher Journal -It is interesting to see how groups are delegating the work. One group with TG, SH and CC had an impasse pretty quickly. I had to intervene to help delegate who would do what. TS, LA and ZS couldn’t decide who would do what so they resorted to Rock, Paper Scissors to define roles. Interesting how they felt it was fair to do it that way. Other groups settled into their roles pretty quickly. I overheard some arguments where kids were saying what resources they have providing a justification for their role.

The following three days the small groups worked in the computer lab to begin planning and researching for their monument and multimedia presentation. Screen shots of some of the multimedia presentations are provided in Figure 3-2. The following

week the groups also had access to a cart of laptops to continue working on their project.

After six total days of working in small groups in class and independently at home, the groups presented their proposals to a committee comprised of students from other sections of the course. The committee used the criteria outlined on the assignment to determine which presentation best met the criteria.

I assessed each group based on the rubric provided in Appendix B. A validation group made up of other teachers also evaluated the presentations using the same rubric.

Conclusion

While this instructional process was unfolding in my classroom, I was collecting and analyzing data to determine the ways *Digital Biographies, a* PBL unit, supported the development of 21st century skills of while simultaneously supporting NCLB accountability standards? In the next chapter I outline how I collected and analyzed various sources of data.

Table 3-1. Biographies, authors and Lexile scores

Title	Author	Lexile Score
Up Close: Rachel Carson	Ellen Levine	1060L
Marie Curie	Kathleen Krull	1050L
The Double Life of Pocahontas	Jean Fritz	910L
Helen Keller	George Sullivan	730L
Michelle Obama	Marlene Brill	940L
Amelia Earhart	Tonya Lee Stone	1000L

Table 3-2. Features of PBL

Features of PBL as outlined by Grant (2002)	Digital Biographies
An introduction to "set the stage" or anchor the activity	The anchor activity for this PBL unit was for the students to create a monument to commemorate a woman from history.
A task, guiding question or driving question	This unit had a “product oriented” driving question. How do we create a memorial to honor an influential woman from history?
A process or investigation that results in the creation of one or more sharable artifacts	The artifact developed by students in this unit was a technology based persuasive presentation and a model of the proposed monument.
Resources, such as subject-matter experts, textbooks and hypertext links	Biographies, websites and print encyclopedias
Scaffolding, such as teacher conferences to help learners assess their progress, computer-based questioning and project templates	Scaffolding was provided through the discussion of the vision, location and rational for the Martin Luther King Monument in Washington D.C. that was under construction at the time of this unit.
Collaborations, including teams, peer reviews and external content specialists	Students were arranged into small groups to collaborate. They also engaged in a form of peer review by serving as a committee that evaluated each groups’ persuasive oral argument and model.
Opportunities for reflection and transfer, such as classroom debriefing sessions	The unit concluded with both small group and whole class discussions about what was learned through the process. The students referred back the KWL document they created at the beginning of the unit.

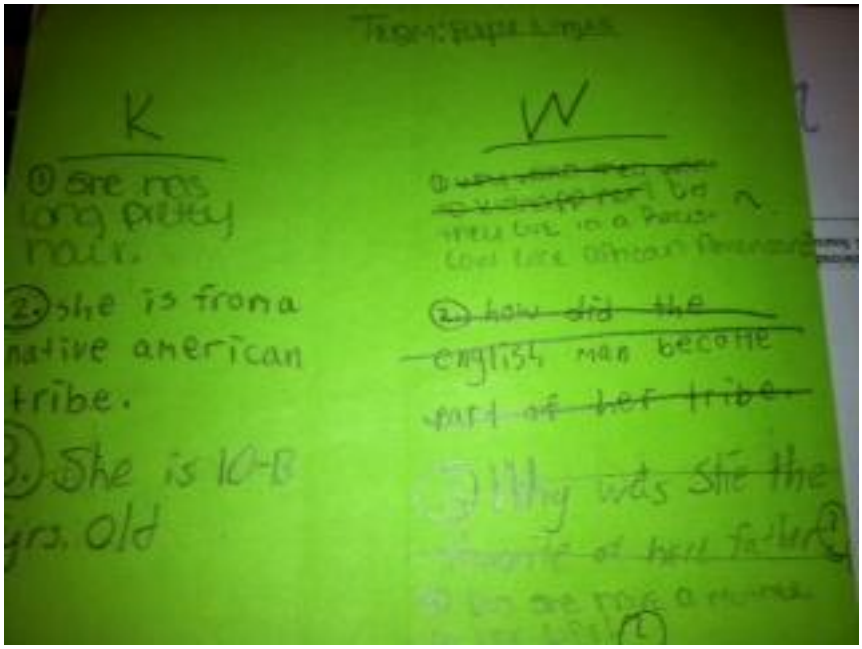


Figure 3-1. Sample of KWL graphic organizer

CHAPTER 4
RESEARCH METHODOLOGY

Introduction

The main purpose of this study was to discover ways *Digital Biographies* enabled me to develop 21st century skills in my students while simultaneously supporting NCLB accountability standards. In this chapter I will discuss how the purpose of this study was achieved. I will discuss the action research model that I used to conduct my research. Additionally, I will discuss the selection of the study group. Finally, I will present data collection and analysis techniques that were employed during the course of this study.

Action Research Model

The purpose of all research is to generate new knowledge; however, McNiff and Whitehead (2006) tell us that action research (AR) seeks to develop a specific type of knowledge. AR, also referred to as *teacher inquiry*, is defined as "systematic, intentional study of one's own profession practice" (Dana and Yendol- Hoppy, 2009, pg. 6). Cochran-Smith and Lytle (1993) echo this definition by stating that AR is "a systematic and intentional inquiry carried out by teachers" (pg. 7).

Dana and Yendel-Hoppy (2009) describe the action research process in specific steps. The process begins with teachers experiencing a real life dilemma or "felt difficulty" that is present in a teacher's work in their classroom. From these felt difficulties, the teacher then develops a "wondering". These wonderings are ideas that teachers have that might alleviate the felt difficulty. Based on these ideas the teacher then develops a plan for collecting and analyzing multiple forms of data to shed light in their wondering. Once the teacher "finds their findings" through data analysis they

extend their learning by writing about it. The final step is sharing their research with others.

Through this systematic investigation, teachers are able to develop knowledge about how to improve teaching practices in order to improve student learning while also gaining a deeper understanding of educational situations and context (Feldman & Minstrell, 2000). AR is a form of research that is done "*by* or *with* insiders" compared to "*to* or *on* them" (Herr & Anderson, 2005, pg 3). McNiff and Whitehead (2006) recommend that the AR model be used to determine if what a practitioner is doing is influencing others' learning or whether something different needs to be done.

Based on the goals and definition of this research model, my role as a classroom teacher puts me in the position of an *insider.* My role as a classroom teacher also puts me in the role of a practitioner. Dick (1993) tells us "when a practitioner uses AR, it has the potential to increase the amount teachers consciously learn from the experience" (pg. 9). My primary goal as a classroom teacher is to influence learning and to implement strategies to best influence student learning. McNiffe and Whitehead (2006) outline the two main purposes for teacher inquiry, to contribute to new practice and to contribute to new theory. AR gave me an approach to systematically investigate my teaching while also contributing to new practice and theory. The goals of AR and goals I have as an educator made the AR model a logical choice to achieve the purpose that is outlined in this study.

Identification of the Study Group

In the 1920s, Lewis Terman began a longitudinal study on gifted children and published his findings in *Genetics Studies of a Genius*. In his report he described gifted individuals as happier, healthier, more popular with their peers, capable of performing

without much external support, and “practically perfect in every way” (Baum, 2004, pg 13). In 1972, the federal government developed a definition of “gifted”. The definition has undergone revisions since that time but the essence of the definition remains the same.

> Students, children, or youth who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services and activities not ordinarily provided by the school in order to fully develop those capabilities (Public Law 103-382, Title XIV, 1988, p. 388).

These descriptions do not consider twice exceptional students or gifted students from special populations. Twice exceptional students are defined as having intellectual capabilities but also have a learning disability (Beckley, 1998). The NAGC defines special populations of students as gifted students that have “additional circumstances or characteristics that can interfere with academic achievement, social/emotional growth, and optimal development of their potential” (National Association for Gifted Children, 2008, “Special Populations Network” para. 1). Examples of special populations include minorities, low socio- economic status, attention deficient disorder, rural, and Autism Spectrum Disorder (ASD).

Many of these special populations of gifted students overlap with the NCLB subgroups. As described in the previous chapter, the subgroups that were of special concern at the site of this study were minorities, students with disabilities and low socio-economic status. These subgroups are also identified as special populations. For the purposes of this study these groups are referred to as *special populations*. Students that are categorized into two or more of these special populations are of even more concern at the school site since their data is essentially counted twice towards meeting

the school's goal of AYP. The study group was comprised of students that are categorized into two or more of the special populations.

Data Sources

To better understand the impact of *Digital Biographies,* a PBL unit, had on 21st century skills and achievement levels, I collected and analyzed both quantitative and qualitative data. Quantitative data included pre and post test scores on the following instruments: Florida Assessment for Instruction in Reading (FAIR) and the Student Tool for Technology Learning (ST^2L). I compared the results of students that represent two or more of the NCLB special populations with those of students that are not categorized into any of the special populations. I also analyzed qualitative data, which included student artifacts and a teacher journal.

Quantitative Measures

Two quantitative measures of student achievement were available as data sources in order to answer my inquiry question (Dana and Yendol-Hoppey, 2006). I wanted to know if a technology supported PBL experience would increase student scores on the following instruments: Florida Assessment for Instruction in Reading (FAIR) and the Student Tool for Technology Learning (ST^2L).

The FAIR test

The State of Florida's Department of Education (2009) describes the FAIR test as a set of assessments that was designed to guide reading instruction. This is not a summative test and it does not replace the Florida Comprehensive Assessment Test (FCAT). Instead FAIR is a tool used to predict future performance on the FCAT. According to the FAIR Technical Manual (2009), the assessment system has two parts; The Broad Screen Monitoring Tool, which evaluates reading comprehension skills, and

the Targeted Diagnostic Inventory (TDI). The TDI is has two tasks, Maze Task and Word Analysis. Maze Task is a measure of how efficiently and effectively a student read and comprehends a text. The Word Analysis task is a measure of how well a student can use phonological (detecting sounds), orthographic (standard usage of words), and morphological (recognizing parts of words and their meanings) information to understand and identify words in a text. FAIR test results report how students perform on each task of the TDI as well as overall reading comprehension scores in the form of Lexile and Reading Comprehension scores. All assessments are used to calculate a student's overall FCAT Success Probability.

Predictive validity for this tool was addressed through a series of linear and logistic regressions (Florida Department of Education, 2009). Item Response Theory (IRT) was used as a method of validation. IRT analysis was used to form a generate estimate of reliability that was at least .90 for each assessment. This generic reliability also provides a marginal estimate of internal consistency (Florida Department of Education, 2009). The FAIR was chosen since it provided data predicting the likelihood of a student performing at or above grade level. This assessment is given several times a school year providing short term data.

ST^2L assessment.

NCLB has specific goals for technology literacy for all students. As outlined in the Enhancing Education through Technology Act of 2001, these goals include improving student achievement through the use of technology, closing the digital divide, and to encourage effective technology integration into existing content area curriculum (United States Department of Education, 2001). Hohlfeld, Ritzhaupt, and Barron (2010) state the ST^2L was developed to help Florida districts assess students' technology literacy

skills in the areas that are outlined by the National Education Technology Standards and to meet the reporting requirements outlined in NCLB. Florida Innovates (2009) outlines that five specific indicators are assessed through the use of ST^{2}L, which include: Technology Operations, Constructing and Demonstrating Knowledge, Collaboration and Communication, Independent Learning and Digital Citizenship.

Hohlfeld, Ritzhaupt and Barron (2010) found the ST^{2}L to be sound assessment for determining technology literacy. Internal consistency was established using the Kuder-Richardson 20 (KR-20) of .95 for the entire tool. Construct validity was obtained by establishing a relationship between the pre-survey score for the relationship between experience levels and correlations among the ST^{2}L and pre-survey scores. All measures were found to be significant. The validation of this instrument as a tool to determine technology literacy made it an appropriate choice for determining student technology skills for this research.

Combined these two tools provided data about the development of the students' literacy skills as well as the development of their skills in using technology.

Qualitative Measures

Student artifacts

Meyers and Rust (2003) tells us that the link between teaching and student achievement can be made through the use of rubrics. A rubric (Appendix B) for the students' final projects was created to assess the Learning and Innovation Skills and Technology as outlined by The Partnership for 21st century skills. These skills include technology tools use, creative thinking, collaboration, and communication skills. The analysis of the student artifacts with the use of the teacher created rubric revealed the extent to which these skills were utilized and developed through this PBL activity.

Teacher journal

Cochran-Smith and Lytle (1993) tells us that teachers' journals are "accounts of classroom live in which teachers record their observations, analyze their experiences and reflect on and interpret their practices over time" (pg.26). A sample of the transcribed teacher's journal can be found in Appendix C.

Data Analysis

Quantitative data was analyzed by performing a repeated measures Analysis of Variance (ANOVA) comparing pre- and posttest scores for the FAIR test and the ST^2L Assessment. The test provided information about whether the difference between the pre and post assessments means is statistically significant, hence providing evidence of if the PBL method of instruction made a significant difference in the student achievement in terms of literacy skills and technology skills.

The teacher journal was coded using the Constant Comparison Method as outlined by Glaser (1965) to reveal patterns and themes. The student artifacts were analyzed using a rubric and comparing the scores of the study group to the comparison group's scores. A validation group was used to establish inter rater reliability.

Conclusion

As a practitioner, my primary goal is to improve my practice to ensure student achievement and student learning. McNiffe (2002) tells us action research is a way to check if what you are doing is working. This form of self-evaluation has helped me improve my professional practice. Riding, Fowell, and Levy (1995) state that through the method of action research there is not a distinction between teaching and researching therefore bringing practice and theory closer together. Through the process I have presented here, I was able to determine if PBL is an effective method to

improve my practice as I develop the literacy skills and 21st century skills. Chapter 5 provides an overview of my results.

CHAPTER 5
RESULTS

Introduction

This chapter outlines the results of an action research project that addressed the ways PBL can develop 21st century skills of underserved students while simultaneously supporting NCLB accountability standards. The first section *Sample* outlines how the study group and comparison group were selected. The next section *Data* is broken down into two subsections. The first, entitled *Quantitative Data* includes *FAIR Test Results* and *ST^{2}L Technology Tool Results*. The second, *Qualitative Data,* includes a description of *Student Artifacts* and *Teacher Reflection Journal.*

Sample

At the time of the study, there were a total of thirteen students that met the criteria for inclusion in the study group, as noted in Table 4-1. The targeted study group was defined as students enrolled in a 6th grade social studies class that were identified as being a member of two of three special populations that are of special concern at the school site. These special populations are: low socio-economic students, students with disabilities, and minorities. At the study school site these groups are of special concern since they are traditionally the groups that fail to meet the AYP goals that are set forth by NCLB.

Low socio-economic students were defined as students that have been identified as eligible for the National School Lunch Program (NSLP). This program provides nutritionally sound and free or reduced lunches to students in public schools (United States Department of Agriculture, 2011). Eligibility for this program is determined by federal income levels and family size and is an indicator for poverty (United States

Department of Agriculture, 2008). One hundred percent of the study group was eligible for the NSLP. Three students had *reduced lunch status*; ten students had *free lunch status.* Of the thirteen students, twelve of them were identified as African American and one was Caucasian. Students were identified as having a disability through special education records. Of the thirteen students in the study group, two of them were identified as receiving services for Specific Learning Disabilities (SLD); three students were identified as receiving services for Autism Spectrum Disorder (ASD). Florida Department of Education defines SLD as, "A specific learning disability is defined as a disorder in one or more of the basic learning processes involved in understanding or in using language, spoken or written, that may manifest in significant difficulties affecting the ability to listen, speak, read, write, spell, or do mathematics" (Florida Department of Education, 2009). ASD is defined to be a "range of pervasive developmental disorders that adversely affects a student's functioning and results in the need for specially designed instruction and related services" (Florida Department of Education, 2009).

The comparison group was selected through simple random sampling of thirteen students that were not categorized into any of the three special populations of special concern in terms of AYP.

Data

Quantitative Data

Quantitative data for this study consisted of pretest and posttest FAIR results for both the study group and the comparison group. The FAIR test provided data on reading skills of the participants. Technology skills and 21st century skills were assessed using pretest and posttest ST^{2}L results for both groups. A repeated

measures analysis of variance (ANOVA) was performed to determine the interaction effect within the study group's pretest and posttest scores.

FAIR test results

A repeated measures ANOVA was performed to determine the effect of the PBL learning experience had on reading skills of the study group. As displayed in Table 4-2, results revealed no statistically significant difference between the pretest score and the posttest scores for any of the categories assess with the FAIR test.

The test showed no significant difference between the pretest and posttest reading comprehension scores for the students identified in the study group, $F(1,27) = .02$, $p = .89$. The Maze Task also showed no statistically significant interaction effect, $F(1,26) = .250$, $p = .621$. The Word Analysis Task results demonstrated no significant interaction, $F(1,27) = .020$, $p = .889$. The repeated measures ANOVA also did not reveal a significantly significant change in Lexile scores for the study group, $F(1,28)= .359$, $p = .554$. The overall FCAT Success Probability Score was not significant, $F(1,28) = 1.21$, $p = .280$.

Overall FCAT Success Probability data for the study group and the comparison group was analyzed. As shown in Figure 4-1, the study group's overall FCAT Success Probability rose from 81.73 to 84.33 from pretest to posttest. The comparison group's overall FCAT Success Probability remained the same. The study group did have an increase; however, it is not considered statistically significant. A between group repeated measures ANOVA reveals the difference between the study group's overall score and the comparison group's overall scores is approaching significance, $F(1,28) = 3.51$, $p = .071$.

ST^{2}L results

Both the study group and the comparison group was administered this assessment prior to the PBL learning experience and again at the conclusion. Descriptive statistics for the mean scores on each of the indicators and overall score are provided in Table 4-3.

A repeated measures ANOVA revealed that there was not a significant interaction effect of PBL at the <.05 level on the study group's Technology Operations mean $F(1, 28) = 1.01$, $p = .323$, Collaboration and Communication mean $F(1, 28) = .11$, $p = .735$, Independent Learning mean $F(1, 28) = .003$, $p = .958$, or Digital Citizenship mean $F(1, 28) = .40$, $p = .531$. The interaction effect the Knowledge Construction indicator was approaching significance $F(1, 28) = 3.65$, $p = .066$. The overall mean scores for the ST^{2}L Technology Tool were approaching significance $F(1, 28) = 4.02$, $p = .055$.

Overall scores of the ST^{2}L for the study group was compared to those of the comparison group, shown in Figure 4-2. Both groups demonstrated an increase in overall scores. The study group rose from 75.40% on the pretest to 84.60% on the posttest. The comparison group rose from 82.46% to 87.40%. The between group ANOVA demonstrated the difference was approaching significance $F(1, 28) = 3.93$, $p = .071$.

Qualitative Data

Qualitative data for this study is provided through analysis of student artifacts with the use of a teacher created rubric and a teacher reflection journal.

Student artifacts

A rubric was created to assess the student groups' final artifact in the following areas: Information skills, thinking and communication skills, creativity, technology tools,

and sources (Appendix B). The 21st Century Partnership (2011) outlines these as skills that support 21st century student outcomes. I evaluated each final product during the oral presentation each group gave to a committee comprised of their peers from other classes. Two additional classroom teachers served as a validation group; they viewed the oral presentations and evaluated each group using the same criteria.

The rubric represents a rating system from excellent to unsatisfactory. Each rating has a corresponding numerical representation. A total of 5 points is the equivalent of excellent, 4 points is the equivalent of very good, 3 corresponds to good, 2 is the equivalent of fair, while 1 is unsatisfactory. Prior to the presentations, I met with the other classroom teachers to come to a consensus of what would earn groups points based on the description provided on the rubric.

Once all the presentations were complete, I used a spreadsheet to record the total number of points earned by each group in each of the areas represented on the rubric. A screenshot depicting the organization of the spreadsheet is provided in Figure 4-4. Mean scores calculated from the teacher researcher's assessment for both the study group and the comparison group is provided in Figure 4-3.

Inter Rater Reliability was established using Pearson's Correlation Coefficient, r=.87, demonstrating a moderately strong correlation between the teacher researcher overall score and the validation group overall score. The mean score for all areas assessed with this rubric for the teacher researcher was 3.72, the validation group overall mean score was 3.57.

The overall mean score based on the rubric data shows that both groups performed at a proficient level in terms of demonstrating 21st century skills in all areas

except for *sources*. The comparison groups' means were higher in all areas except *creativity*.

Teacher reflective journal.

Dewey (1933) heralded the value of reflection and considered it a form of problem solving. Schon's (1983) work on reflection emphasizes the importance of stepping back from the action in order to make sense of it. Dana and Yendol- Hoppey (2009) recommend several strategies to capture the "data life in school" (pg 73). One such strategy is a Teacher Reflective Journal. These journals provide a way for teachers to record observations, analyze experiences, and to reflect on practices and what is happening in the classroom (Cochran- Smith & Lytle, 1993).

I maintained a journal throughout the process of the PBL experience. Several times throughout the day, I recorded my observations and thoughts of what occurred in my classroom as the students progressed. I used a free writing method to prevent myself from over-thinking or editing at the time of the journal entry. Throughout the course of the study, I recorded 46 handwritten pages of observations. This provided me a way to record a snap shot of what was happening and my thoughts about the occurrences. I also recorded my initial reflective thoughts on my observations. Sample pages of the original journal can be found in the Appendix E. At the conclusion of the project, the reflective journal was transcribed. A sample page of the Transcription Protocol is provided in Appendix C.

Saldaña (2003) defines a "code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence capturing and/or evocative attribute for a portion of language based or visual data" (pg. 3). I used the Constant Comparison Method (Glaser, 1967) to analyze the transcripts. I began with

an inductive analysis of the transcripts by applying a descriptive code to information that seems salient to me during the first reading. I reread and continued to analyze the data looking for similarities and differences, which enabled me to combine and eliminate codes during each subsequent reading. By constantly comparing each data piece, I was able to develop several codes. These codes are outlined in Table 4.4. I used coding memos (Appendix D) to analyze and refine the codes until each code became saturated, hence developing themes (Glesne, 2006).

This analysis revealed four pertinent themes from the Teacher's Reflective Journal. The themes and subthemes that developed into themes are featured in Table 4-4. The coding revealed four major themes: *Students Cooperating, Students Detracting, Technology as an Extension and Technology as a Distraction.* The *Students Cooperating* theme is defined as instances where students are collaborating, acting as a team or providing leadership is observed and noted in the teacher journal. *Students Detracting* highlights instances when students detracted from the task at hand through a variety ways. *Technology as an Extension* documents instances of when groups of students extended their use of technology by incorporating different forms of programs to enhance the basic presentation. Finally, *Technology as a Distraction* looks at how the software and other functions on the computers acted as a distraction for students during the PBL process.

Summary of Data Analysis

Quantitative data analysis revealed that PBL did not have an impact on students' reading skills, as they are measures on assessments required to meet the NCLB standards. The study group's scores did increase as a result of PBL, however it was not enough of an increase to be considered statistically significant. Data analysis

showed similar results for the ST^2L assessment results. There were increases in scores for the study group but scores were not statistically significant. Results did approach significance for the overall ST^2L Scores as well as the Knowledge Construction construct.

Qualitative data analysis showed that students in both the study group and the comparison group performed at a proficient level for each of the 21st century skills that were assessed based on the teacher created rubric, with the exception of one area. That area was properly referencing and citing sources. The reflective journal demonstrated that collaboration and technology use of students could be both a blessing and a curse. Students working together in small groups can increase collaboration and cooperation while at the same time provide opportunities for students to distract each other from the task. Technology can be a distraction in terms of games, chats, and searching images not related to the project. Technology can also provide a way for students to extend their project with productivity and presentation tools.

Chapter 6 will discuss the impact these findings will have on my professional practice. It will also discuss implications for professional educators that look to use PBL.

Table 4-1. Final study group

Student Identifier	Gender	Free/Reduced Lunch	Ethnicity	Disability
Student A	M	Reduced	Caucasian	SLD
Student B	F	Free	African American	
Student C	F	Free	African American	
Student D	F	Free	African American	
Student E	M	Reduced	African American	ASD
Student F	M	Free	African American	ASD
Student G	F	Free	African American	
Student H	F	Free	African American	
Student I	M	Free	African American	ASD
Student J	M	Free	African American	
Student K	F	Free	African American	
Student L	F	Reduced	African American	
Student M	F	Free	African American	SLD

Table 4-2. Analysis of variance for FAIR test

FAIR Test	Underserved Population		Comparison Group		Interaction Effect	
	Pre	Post	Pre	Post	F	p-value
Word Analysis	69.28	75.64	72.13	79.60	.02	.889
Lexile Score	1004.00	1072.33	1135.66	1162.00	.35	.554
Reading Comprehension	53.00	59.73	64.21	69.57	.02	.890
Maze	65.71	76.71	73.42	81.92	.25	.621
FCAT Success Probability	81.73	84.33	96.00	96.00	1.21	.280

Table 4-3. Analysis of variance for ST^2L results

Assessment	Underserved Population		Comparison Group		Interaction Effect	
ST^2L	Pre	Post	Pre	Post	F	p-value
Tech Operations	79.13	86.60	90.73	95.13	1.01	.323
Knowledge Construction	68.26	79.80	76.26	80.73	3.65	.066
Collaboration and Communication	76.33	79.66	80.53	84.93	.11	.735
Independent Learning	69.33	77.66	77.26	85.80	.003	.958
Digital Citizenship	86.53	90.60	91.20	93.53	.40	.531
Overall	75.40	84.60	82.46	87.40	4.027	.055

Table 4-4. Teacher reflective journal themes

Overarching Themes	Codes and Sub codes
Students Cooperating	Leading
	Tutoring
	Leading
	Redirecting
	Justifying
	Defining Roles
	Delegating
	Collaborating
	Negotiating
	Cooperating
Students Detracting	Interpersonal Distractions
	Crying
	Sabotaging Group
	Talking
	Name Calling
	Chatting
	Intrapersonal Distractions
	Avoiding work
	Gaming
Technology as an Extension	Productivity
	Google Earth
	Gmail
	Linking video
	Googling
	Presentation
	Wordle
	Glogster
	Gaggle Documents
	Mine Craft
	Tombstone Creator
	Sumo Paint
Technology as a Distraction	Organization/Skills
	Lost Storage
	Lacking Skills
	Off Task Behaviors
	Searching Images
	Sumo Paint
	Chatting
	Gaming

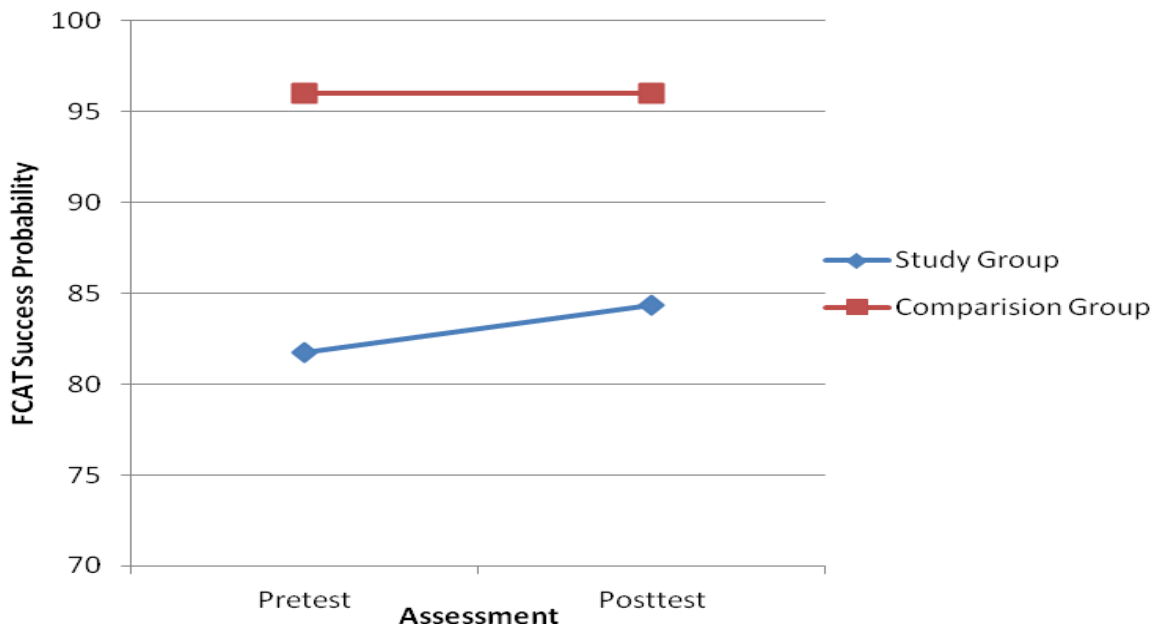


Figure 4-1. Overall FCAT success probability for study group and comparison group

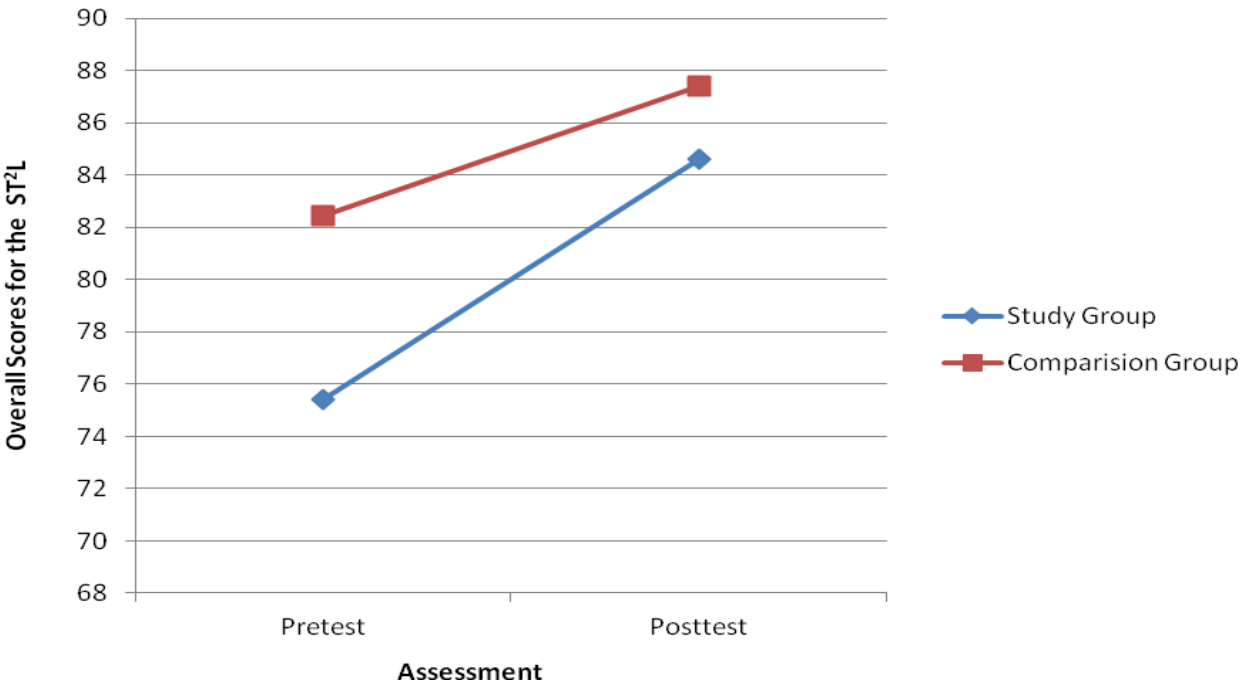


Figure 4-2. Overall scores for ST^2L

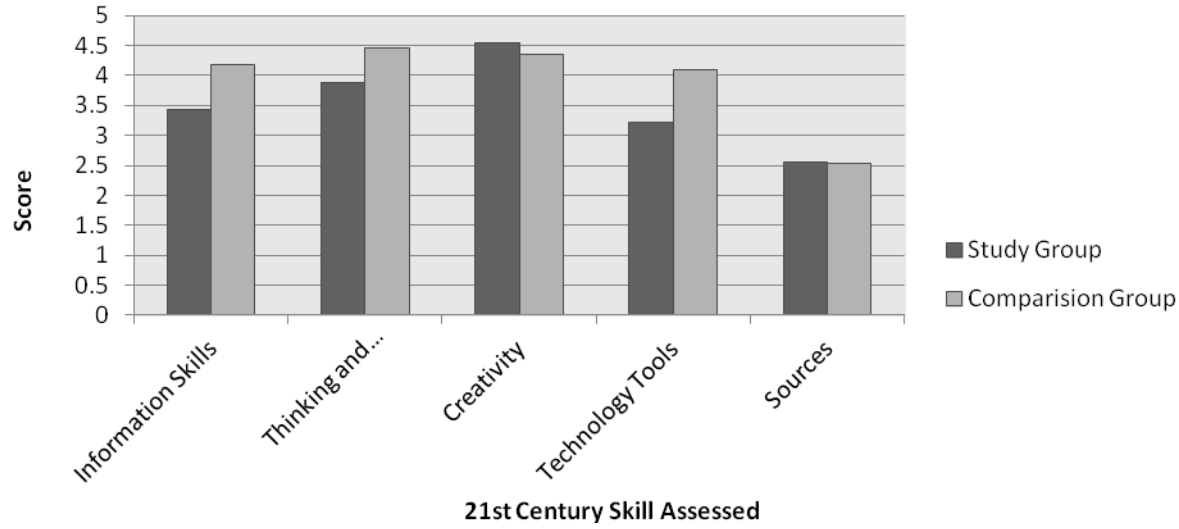
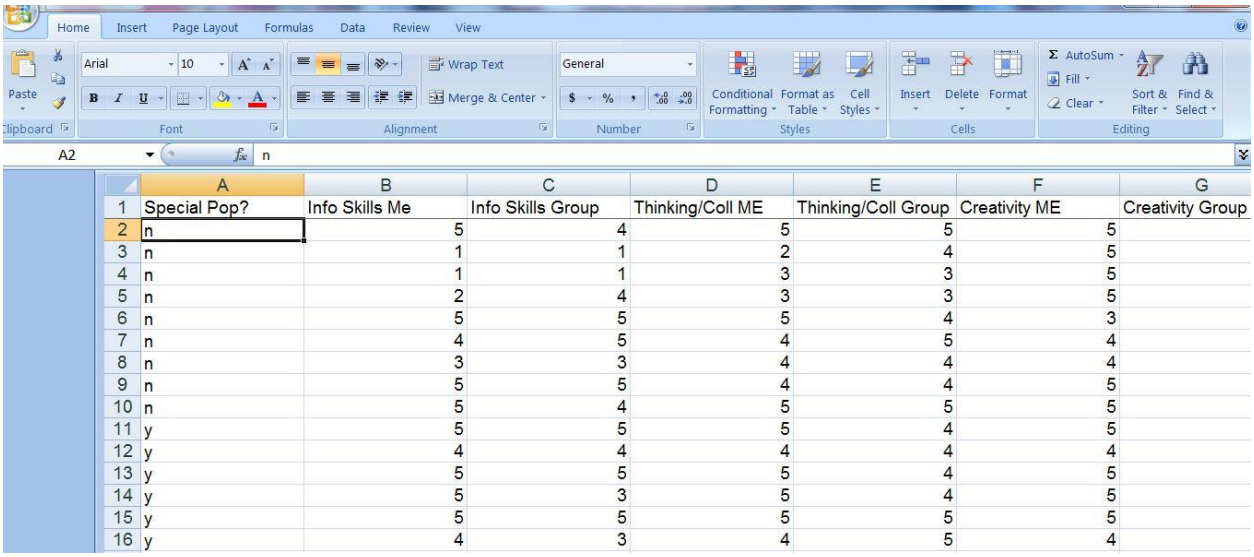


Figure 4-3. Rubric scores



	A	B	C	D	E	F	G
1	Special Pop?	Info Skills Me	Info Skills Group	Thinking/Coll ME	Thinking/Coll Group	Creativity ME	Creativity Group
2	n	5	4	5	5	5	
3	n	1	1	2	4	5	
4	n	1	1	3	3	5	
5	n	2	4	3	3	5	
6	n	5	5	5	4	3	
7	n	4	5	4	5	4	
8	n	3	3	4	4	4	
9	n	5	5	4	4	5	
10	n	5	4	5	5	5	
11	y	5	5	5	4	5	
12	y	4	4	4	4	4	
13	y	5	5	5	4	5	
14	y	5	3	5	4	5	
15	y	5	5	5	5	5	
16	y	4	3	4	5	4	

Figure 4-4. Screenshot of rubric data

CHAPTER 6
DISCUSSION AND IMPLICATIONS

This final chapter reviews the purpose of this action research study, reviews the findings, discusses the claims that can be made based on the data, and presents conclusions. Limitations of the study are discussed. Recommendations for future research are presented. Finally, I discuss the impact the results of this inquiry have on my own classroom practices and the implications it has for my future work.

Summary of the Study

The purpose of this research study was to examine PBL through the lens of the 21st century. The turn of the century and legislation that was introduced shortly after have greatly impacted my classroom practices. The new century brought with it the need to develop 21st century skills. The Framework for 21st Century Learning describes these skills (which include, critical thinking, communication, collaboration, and creativity) as necessary for students to be ready for the 21st century workforce. In 2001, The No Child Left Behind Act was passed bringing with it heightened accountability standards for students, teachers, and schools. An integral part of this legislation was the concept of Adequate Yearly Progress. AYP outlines guidelines for the success of all students including students that represent specific traditionally underserved subgroups. These include students with disabilities, minorities, and students with free or reduced lunch status.

Dana and Yendol-Hoppey (2009) tells us that teacher inquiry often times starts with a “felt difficulty”. Adequately developing 21st century skills while addressing accountability standards outlined in NCLB proved to be a “felt difficulty” in my teaching practice. These two goals were being addressed as mutually exclusive of each other,

which lead me to wonder what ways could both of these valuable goals be addressed effectively and efficiently. This felt difficulty and wondering led me to develop the research question that is addressed in this action research study: In what ways does *Digital Biographies, a* PBL unit, support the development of 21st century skills of while simultaneously supporting NCLB accountability standards?

In order to answer this question, I implemented a teacher inquiry study in my classroom that was specifically designed to develop reading comprehension skills and vocabulary development, encourage collaboration, communication and foster the use of technology based productivity and presentation tools. Lesson plans are provided in Appendix A. I specifically examined the impact *Digital Biographies* had on students that were group into two or more special populations as they compared to students that were not included in any of the identified special populations.

The first part of the study involved grouping students based on Lexile scores. Based on their reading level, groups of students were assigned biographies of influential women in history to read independently over a six week span. During this time, students completed assignments I designed focusing on reading comprehension and vocabulary development.

At the end of the six week independent reading time, students reassembled into small groups with other students that read the same biography. This small group worked as a committee to design a proposal for a monument to commemorate this person's impact on history. Required for each proposal was a summary of the historical figures life events and impact on society, site location with rationale, a model of the monument and an explanation of the design process, as well as the use of at least one

technology based presentation tool. These persuasive presentations were delivered to a panel of students from other class periods that use a criterion similar to the UNESCO's World Heritage Sites to determine which group best met the outlined standards.

Both quantitative and qualitative data was collected and analyzed to determine the ways PBL supported the development of 21st century skills and literacy skills. Quantitative data included an analysis of pre and post test scores of the study group (n=13) and the comparison group on two separate assessments. The FAIR test provided information on the students' performance in terms of the literacy accountability standards outlined by NCLB. Pre and post test results from the ST^{2}L provided evidence of the development of 21st century and technology skills.

Qualitative data was collected through the use of a rubric (Appendix B) I created to assess the groups' final products based on the demonstration of 21st century skills. Inter-rater reliability was established with the use of a validation group comprised of other classroom teachers. I also maintained a teacher's reflective journal to capture my thinking as the process unfolded (Dana & Yendol-Hoppey, 2009). I transcribed the journal and through the use of the Constant Comparison Method I was able to see themes emerge (Glaser, 1965).

Summary of the Findings

Dana and Yendol-Hoppey (2009) states that findings in teacher inquiry can be revealed by reflecting on the learning that occurred and supporting the learning with data. I have chosen to illustrate my findings, hence my learning, by making claims based on data (Dana & Yendol-Hoppey, 2009). I was able to arrive at these claims through the analysis of the data and clarifying my thinking about my inquiry. Each of the

claims address the original research question: In what ways does *Digital Biographies, a* PBL unit, support the development of 21st century skills of while simultaneously supporting NCLB accountability standards?

Category 1: Student Reading Achievement

Claim 1. Students who participated in the Digital Biographies PBL unit demonstrated an increase in reading achievement.

As outlined in Chapter 4, a repeated measures ANOVA was performed to determine the interaction effect within the study group's pretest and posttest scores for both the Broad Screen Monitoring Tool and the Targeted Diagnostic Inventory portions of the FAIR assessment. In every area assessed, Word Analysis, Lexile Score, Reading Comprehension and Maze, the special populations group demonstrated an increase in the mean score demonstrating an overall improvement in student performance. The overall FCAT Success Probability mean also increased for the special populations group from the pre assessment to the post assessment. This too reflects an improvement of student achievement. However, the increases were not considered to be statistically significant. A p-value of .05 is generally considered to be statistically significant (Huck, 2004). With the significance level set at .05, the results for the varied tests were not considered to be statistically significant.

The lack of significant gains could be attributed to the time the study was conducted. The study was completed between the Winter and Spring Assessment Periods for the FAIR test cycle. This small window of time may have proved to be too short of a time period for significant gains to be established.

While the statistical tests indicate no statistical significance, the Florida Department of Education (2010) offers guiding questions when determining student

progress from assessment period to assessment period. These guiding questions simply ask: Did the Reading Comprehension score increase? Did the Maze Score increase? Did the Word Analysis Score increase? Since these assessments have the same metric across time they are considered the best indicators of a students' progress (Florida Department of Education, 2010). Each of the overall means of these three assessments increased throughout this study. While statically significant increases were not noted, based on the measuring stick set out by the State of Florida, it can be determined that the special populations group did indeed make progress in terms of reading achievement. The Reading Comprehension mean rose from 53.00 to 59.73. The Maze mean for the study group increased from 65.71 to 76.71. Similarly the Word Analysis means of the study group also increased from 69.28 to 75.64.

The Lexile Framework for Reading (2011) explains that the Lexile score provides valuable information about a reader's ability to read and comprehend text. While there is not a direct correlation between grade level and Lexile scores, typical scores for each grade level are reported. The Lexile Framework for Reading (2011) explains the mid-year inter quartile range for 6th graders is 860L-920L. The special populations group midyear Lexile mean was 1004. Knutson (2011) explains that based on this score, expected annual growth is 38 points. Throughout the course of this study, the mean Lexile score rose 68 points. The documented increase in the Lexile scores supports this claim.

This claim is further supported by literature that cites that PBL can lead to increases in student achievement. Gultekin (2005) and Kucharski, Rust and Ring

(2005) states that PLB supports overall academic achievement and success in specific content areas.

Claim 2. Students in the special populations group had an increase in FCAT Success Probability Rates while the comparison groups' probability remained the same.

Based on The Florida Center for Reading Research (2010) score coding, an FCAT Success Probability of 85% or higher codes the students in the green zone, which indicates the student has an 85% or better probability of scoring a level 3 or higher on the FCAT. Students are coded as yellow if their success probability rate falls between 16 – 84% and red of the probability of success is less than 15%. The overall goal is to move students in the red and yellow zones into the green zone.

Overall FCAT Success Probability rates for the study group increase from 81.73 to 84.33 during the study period. This increase moved the study group closer to the goal of the green zone. The comparison group's overall mean for probability remained the same at 96.00, which is coded in the green zone. While the comparison group did demonstrate increases in means of the other assessments, those increases did not translate to an increase in an increase of FCAT Success Probability.

As a practitioner-researcher I am charged with developing my own criteria to evaluate my practice (McNiff & Whitehead, 2006). Based on the data presented from the FAIR test, I can assert that PBL is a tool that can be used to increase student achievement in reading. This assertion is echoed by Boaler (1994) who tells us that students that participated in PBL activities achieved higher scores on content knowledge assessments those that did not. Several studies support the notion that PBL can increase student achievement (Geier et al., 2008; Strobel, J & van Barneveld, A,

2008; Gultekin, 2005; Hernandez- Ramos & De La Paz, 2009; Kucharski, Rust & Ring, 2005). Chu, Tse, Low and Chow (2011) specifically provide support for this claim by stating that PBL supported the development of students' reading abilities.

Category 2: Technology Literacy

Claim 1. Students demonstrated an increase in technology literacy skills after participating in the Digital Biographies PBL unit.

In every area of the ST^2L, there was an increase in the mean demonstrating an overall improvement of students' technology literacy skills. However, the change in the categories of Technology Operations, Collaboration and Communication, Independent Learning and Digital Citizenship was not considered to be statistically significant. The Knowledge Construction indicator and the overall scores for this instrument were approaching significance.

The first indicator approaching significance was Constructing and Demonstrating Knowledge. This indicator evaluates a students' ability to carry out a variety of tasks. These include but are not limited to properly using tools found in word processing software, editing images, properly using web browser functions and conducting advanced searches and evaluating electronic sources. The improvement in this area could be due to the fact that of all the tasks assessed by the ST^2L, the skills categorized in this indicator were most utilized by students throughout the project. While students were observed performing tasks representative of all indicator areas, the vast majority of observations, as documented in the teacher reflective journal, would fall into this category.

The overall score for the ST2L was also approaching significance with a p-value of .055. This indicates that PBL is an effective way to increase technology skills and

literacy in students. This finding is similar to Seo, Templeton and Pellegrino (2008) that states that students that participated in PBL learning have a higher acquisition of multimedia knowledge than those that did not.

Claim 2. The study group had a greater increase in Constructing and Demonstrating Knowledge compared to the comparision group.

I noted based on the data on this indicator, students in the study group comprised of special populations had a greater increase in performance in this area than the comparison group. The study group's mean rose 11.54% while the comparison group's mean rose 4.47%. Literature supports this claim that students with lower achievement levels demonstrate a much higher increase in critical thinking, synthesizing, and evaluating as compared to their higher achieving peers, as a result of PBL (Horan, Lavaroni & Beldon, 1996).

Claim 3. The technology achievement gap between the study group and the comparision group closed after the implementation of the Digital Biographies PBL unit.

The National Center for Educational Statistics (2011) describes that "Achievement gaps occur when one group of students outperforms another group and the difference in average scores for the two groups is statistically significant". Research tells us that a technology achievement gap exists between underserved students such as minorities, students in poverty and students with disabilities and their peers (Margolis, 2008).

The data comparing the pretest scores of the ST^2L demonstrated a gap between the special populations group and the comparison group. The special populations group's pretest overall mean was 75.40 while the comparison group's overall mean was 82.46. The difference between these two scores for the pre-assessment was 7.06. Both

groups demonstrated an increase in their overall means from the pretest to the posttest. However, they demonstrated more of an increase from the pretest to the posttest. There was a difference of 2.50% between the study group's overall posttest mean the comparison's group's overall posttest mean. While there is still a gap between the overall scores of the two groups, the data suggests the gap between the two groups was narrowed due to the PBL learning experience.

Category 3: 21st Century Skills

Claim 1. Digital Biographies supported the development of the 21st century skill of Learning and Innovation.

The Partnership for 21st Century Skills (2011) describes specific student outcomes. The Learning and Innovation Skills include the "4 C's" which include Critical Thinking, Communication, Collaboration and Creativity.

Clear communication includes the ability to relay thoughts and ideas in a variety of mediums and media. Effective collaboration is described as the ability to work with others to achieve a common goal (The Partnership for 21st Century Skills, 2011). The Partnership describes creativity as the ability to think creativity and work creatively with others. Several pieces of data support the claim that PBL supports the development of these learning and innovation skills.

The teacher created rubric was designed to assess specific 21st century skills. One area assessed using the rubric was "Thinking and Communication". This indicator was designed to measure the students' ability to demonstrate in-depth understanding and insight into the topic. Both the special populations group and the comparison group demonstrated the ability to clearly communicate their ideas with the assistance of multimedia. On a five point scale, the special populations group's mean for this

indicator was 3.88. The comparison group's mean was 4.45. The comparison group's mean was higher but both groups performed at a level considered "good" based on the rubric.

ST^2L data helps to support this claim. Both groups demonstrated an increase in overall mean for the Collaboration and Communication section of the instrument. There was not a statistically significant increase between the pretest and posttest but an increase in the overall mean was recorded. The special populations groups' mean rose 3.33 points from pretest to posttest; the comparison group's mean rose 4.40.

Themes that emerged through the coding of the teacher journal provide evidence that PBL supports collaboration. "Students cooperating" is a theme that materialized through the analysis of the teacher journal transcript using the Constant Comparative Method (Glaser, 1965). The saturation of codes that led me to develop the subthemes and overarching theme of student cooperating provides strong evidence to support this claim.

Creativity is one of the four C's that that comprise the Learning and Innovation Skills section of the Framework for 21st Century Skills. The rubric was used to assess how the final products produced by the students demonstrated original thought and inventiveness. Both the special populations group and the comparison group demonstrated high levels of creative thought and inventiveness. This is the one area where the special populations group outperformed the comparison group during this study. The special populations group's overall score in the area of creativity was 4.55. The comparison group's overall score was 4.36.

Claim 2. Students participating in the Digital Biographies unit demonstrated the development of Information and Communication Technology (ITC) Skills.

In addition to Learning and Innovation Skills, The Framework for 21st Century (2011) learner outcomes included the development of Information and Communication Technology Skills, as shown in Figure 5-1. ICT Literacy is described as the ability to apply technology effectively to "research, organize, evaluate and communicate information". Data presented supports the claim that PBL is an effective tool to develop ICT skills.

Observations as revealed by the teacher journal demonstrate that students were able to effectively access, manage and communicate information. A theme that emerged through the coding and analysis of the teacher journal was "Technology as an Extension". This theme documented instances of when students used technology to support productivity and the development of their presentation. Students were able to access a variety of technology tools, including search engines, online maps and cloud computing, to gather and organize background information. A variety of presentation tools were employed by the students to effectively create their final products. Students demonstrated the ability to merge different presentation tools into one presentation to make it more effective.

How well students were able to use an extensive variety of technology and presentation tools was also assessed using the rubric. This included assessing students' use of a variety of programs, software, graphics, video, links, sound, images. Both the special populations group and the comparison group scored well in this area

on the overall final products. The special populations group's mean for this area of assessment was 3.22. The comparison group's mean was 4.09.

Category 4: Unintended Effects

The action research methodology of this study lends itself to validity questions (Feldman, 1994). One way to address the question of validity is to provide unintended effects of the study (Elliott, 1991). After reflecting on the data, I realized that there are some unintended effects of implementing PBL learning experiences.

Claim 1. Technology was a distraction during the Digital Biographies PBL unit.

Through coding my teacher journal a theme that emerged was that technology can be a distraction to learning. While students did show growth in the area of technology skills and using technology tools, incidences of technology being a distraction were also noted. The most noted area where technology was a distraction was with off task behaviors. This included using technology to chat and play games when instead of working. Using tools in an inappropriate manner also was revealed as being disruptive.

Claim 2. Collaboration was a distraction during the Digital Biographies PBL unit.

Much like the technology being a distraction, the collaborative nature of the project was a distraction at certain times. Again, the students did demonstrate growth in the area of cooperation and collaboration but there are instances documented in the teacher reflective journal where the nature of the group detracted from the task at hand. This included power struggles within the group and socializing with group members instead of working.

Limitations

A limitation of this study is the sample size. Small sample sizes can make it difficult to see significant statistical relationships to develop (Huck, 2004). This small

sample size also makes it difficult to generalize the results to a larger population based on this study.

The trustworthiness of action research is often questioned compared to other research methodologies (Feldman, 1994). One reason for this is that action research is conducted in a single classroom thus the results are not able to be generalized on a larger scale. This study was conducted in a single classroom therefore the validity of the study could be challenged.

Teacher inquiry is employed by classroom teachers to improve practice by reflecting on that practice (Dana & Yendol- Hoppy, 2009). My overall goal for this study was to look for ways to improve my practice. Since I designed this PBL unit, I inherently believed that this type of learning experience could prove to be effective. In retrospect, a certain amount of bias was present since I believed and wanted PBL to have a positive impact on student achievement. I didn't consider that other delivery methods could be as effective. Similarly, a limitation to this study is self reported data. The teacher reflective journal and results of the rubric were self reported. Self reported data can add to bias through selective memory of the researcher.

Recommendations

The claims and limitations of this study leads to recommendations for future research and classroom practice. This section discusses those recommendations.

Recommendations for Future Research

This study demonstrates that PBL shows promise as a method for increasing reading achievement while simultaneously developing 21st century skills of underserved students. While growth was documented in areas of reading achievement and the development of 21st century skills, it was not considered to be statistically significant.

As mentioned in the limitations section, this lack of statistical significance could be due to the small sample size. Thomas (2000) recommended that research on PBL extend past individual classrooms to the implementation of PBL on a school, institutional or district level. Thomas' recommendation paired with the limitation of the small sample size sets the stage for the recommendation for the replication of this study on a school or district level. Such research would address the limitation of the small sample size and Thomas' recommendation. This also would address the limitation of the validity of action research in an individual classroom which would allow for results to be generalized to a larger population and increase the impact studies such as this could have on policy.

This study was conducted over a period of approximately six week. Data was collected from the winter assessment period to the spring assessment period. This could have contributed to the lack of statistically significant gains. Examining the effects of PBL over a longer period of time that includes more assessment periods could add to the discussion.

Thomas (2000) called for further research that would compare PBL as a teaching method to other traditional methods. This study does not address this recommendation however; I echo Thomas' original recommendation that studies that utilize experimental comparisons would be an asset to both researchers and practitioners. Additionally, Thomas (2000) called for research about the effects PBL has non subject matter knowledge like social skills and independent learning skills. This study does address these two areas however, additional research on this topic would add to the breadth and depth of our understanding.

Most of the existing research on PBL focuses on a prepackaged curriculum (Thomas, 2000). Individual classroom teachers who are eager to design and implement PBL in their classes have little formal education on the learning theory, best practices and instructional models that are involved with this methodology (Thomas, 2000). The body of knowledge on PBL would benefit from future longitudinal studies that examine the effects long term professional development would have on student achievement.

Recommendations for Practitioners

When I developed the lesson plans for this unit, I focused the lesson on "essential questions". These essential questions can be found in Appendix A. Blumenfeld et al. (1998) explains that in order for a PBL learning activity to remain on track they should be built around "driving questions". The Galileo Educational Network tells us the goal of both of types of questions is to increase critical thinking skills and to ground the lesson. Without well designed questions, due to the opened ended nature of PBL, projects can become derailed as students and teacher find themselves exploring information that does not address the driving question (Barron et al., 1998). I recommend that practitioners employ a methodical approach to developing these questions, such as Wiggins and McTighe's (2005) *Understanding by Design* (UbD) method. This methodology, also called *backwards design*, starts with outlining specific learner outcomes and then work to develop curriculum to support those learner outcomes. Deliberate and reflective development of essential questions will provide the scaffolding needed to guide the learner through the PBL experience.

The collaborative nature of this PBL experience being a distraction proved to be an unintended effect. After reflecting, I think this issue could have been avoided. My recommendation is to provide students with specific guidelines for how to collaborate.

One such method is to provide students with individualized accountability standards for the duration of the project (Barron et al., 1998). This would allow each student to understand what is expected of them at each phase of the project. I also recommend daily debriefings with the teacher where proper collaborative discussion skills are modeled and encouraged to help to alleviate the distraction. The jigsaw method could also be utilized to provide students with distinct roles to avoid conflict (Brown, 1992).

Thomas (2000) tells us evidence suggests that students exhibit difficulty with self directed learning and using technology effectively during PBL experiences. Technology was a distraction during this study with instances of students not using it effectively and efficiently to complete the task. Looking back, I think the technology became a distraction when students were unsure of the next steps necessary in their research.

Polman and Pea (1997) explains that students engage in “unguided discovery” where students spend large amounts of time struggling with periods of being unproductive. I recommend using guided inquiry to provide a balance between student autonomy and structure to avoid such struggles (Kuhltau, Mariotes and Caspari, 2007).

The FAIR data on the students proved to be a valuable tool in the development of the PBL unit. The deeper I dug into the data the more I understood the challenges and successes my students were having with the content based reading material in my classroom. Traditionally, reading teachers use diagnostic tools such as this to make curriculum decisions. However, based on my experience with this study, I recommend content area teachers becoming well versed in the standardized data pertaining to their students’ reading abilities. This goes beyond analyzing achievement levels and developmental scale scores. Content area teachers should explore their students’

reading comprehension skills along with phonological, orthographic and morphological abilities to inform their practice as they develop any curriculum.

This study looked at how PBL supported technology literacy by analyzing overall data from the ST^2L assessment in the areas of technology operations, collaboration and communication, knowledge construction, independent learning and digital citizenship. The unit in this study was designed to address all areas assessed. However, for classroom teachers, I recommend designing and utilizing lessons that address specific areas that are assessed with this tool. For example, one PBL experience could focus on the content area while developing and assessing digital citizenship skills while another looks at technology operations. This allows for a deeper understanding of the data that allows teachers to put students in learning situations that could work to more effectively develop their technology literacy skills.

Conclusion

My research revealed ways PBL shows promise as a way to help students meet the challenge of developing 21st century skills while meeting the demands of the NCLB accountability standards. Mean scores in all areas of assessed in terms of reading and 21st century skills increased for the underserved population however, these increases were not statically significant. The underserved students demonstrated a level of proficiency of 21st century skills based on the result of an assessment using a rubric. My research also provides examples of how the format of a PBL experience can prove to be a distraction to learners.

This research informs my own personal professional practice as it indicates to me that PBL shows promise as an effective instructional method in the lens of the 21st century. This research has further implications for all classroom teachers in light of the

fact that NCLB waivers are becoming a trend. The Center on Educational Policy (2012) tells us that NCLB waivers are being issued to states like Florida to ease the accountability demands at the federal level. These waivers allow states to set their own academic standards (United States Department of Education, 2012). A key to these waivers is that they provide flexibility to states. Under the old plan, the interventions utilized to increase student achievement were not differentiated to meet the needs of the schools or the students at the schools (The Center on Educational Policy, 2012). The waivers provides the freedom to schools and districts to implement a variety of interventions, reduces the over reliance of standardized tests and provide a well rounded curriculum to students. Existing literature and this research provides a strong argument that PBL can be an effective intervention to provide a well rounded education as we move into the era of NCLB waivers.

APPENDIX A
LESSON PLANS

Table A-1. Lesson plans

Title	Digital Biographies
Creator	Lisa Marie Holmes
Subject	6th Grade Gifted Social Studies
Project Description	Students will be assigned one of eight biographies to read about various women from history. They will be placed in small groups with other students that are reading the same biography. The group will create a monument commemorating the individual and her accomplishments. There will be specific criteria that the monument must meet. Students will present their proposal for their monument to another group of students from other class periods which serves as a selection committee. The students from the other class periods will use the criteria to determine which presentation makes the best argument for the creation of a monument. The monument that best meets the criteria and the group that makes the best argument will be "selected" for creation. Students will infuse technology and multimedia into the presentation. Literacy strategies based on data from students' FAIR assessment will be infused into the lesson plans.
Standards	SOC.6.SS.6.W.1.3 - - Interpret primary and secondary sources. SOC.6.SS.6.W.1.6 -- Describe how history transmits culture and heritage and provides models of human character. SOC.6.SS.6.G.1.4 - Utilize tools geographers use to study the world. SOC.6.SS.6.W.1.1 - Use timelines to identify chronological order of historical events. LA.8.2.2.4 - Identify and analyze the characteristics of a variety of types of text (e.g., reference works, reports, technical manuals, newspapers, magazines, biographies periodicals, procedures, instructions, practical/functional texts); LA.8.1.6.5 - relate new vocabulary to familiar words LA.8.1.7.1 - use background knowledge of subject and related content areas
Essential Questions:	What is Women's History Month? What is the purpose of Women's History Month? How is it similar to Black History Month? Who are some influential women from history? What did they do and why are they notable? How can various women from history be memorialized? What makes a good monument?

Table A-1. Continued

Title	Digital Biographies
Creator	Lisa Marie Holmes
Subject	6th Grade Gifted Social Studies
Literacy Skills	
Activating Prior Knowledge:	After being assigned a biography, students will activate prior background knowledge by creating a KWL chart. The All Write Round Robin (Kagan Structure) will be used the K column of the chart. Once the K column of the chart has been completed, students will be provided with their copy of the biography. They will read the back cover of the biography and using the same All Write Round Robin Structure, they will collaboratively complete the W column of the chart. The L column of the chart will be completed at the end.
Vocabulary Development:	As students are doing independent reading, I will provide Post- It notes. Students will mark words (at least 5 each week) that they want to learn more about later. These words become the weekly "Biography Vocabulary" list for students to work with for weekly homework. They will use context clues to predict what they think each word means and then provide a definition of each word.
Active Literacy:	Students will summarize major events by sequencing key events as they read the biography.
21st Century Skills	
Information and Communication Skills:	The ability to understand, manage and create effective oral, written and/or multimedia communication in a variety of forms and contexts. Students will demonstrate this skill by collaboratively creating an electronic product to use as part of their presentation of their proposed monument.
Thinking and Reasoning Skills	Students uses multiple technology tools for gathering information in order to solve problems, make informed decisions and present and justify solutions. Students will use the internet to find credible sources for information that will become part of their presentation of their proposed monument.

Table A-1. Continued

Title	Digital Biographies
Creator	Lisa Marie Holmes
Subject	6th Grade Gifted Social Studies
21st Century Skills	
Creativity and Innovation Skills	Demonstrating originality and inventiveness in work; developing, implementing and communicating new ideas to others. Students will demonstrate this skill through the model of the monument they designed and the use of technology/presentation tools.
Grouping	Students will be divided into 7-8 groups. Each group will be assigned a biography of a woman from history to read. Book titles will be assigned by Lexile measure. Students will be assigned a title within their Lexile range. Students will be grouped together according to the title they read. This is the group they will work with collaboratively with for the final artifacts.

Table A-1. Continued

Title	Digital Biographies
Creator	Lisa Marie Holmes
Subject	6th Grade Gifted Social Studies
21st Century Skills	
Process	Phase 1 An introduction to Women's history month will be presented as a whole class discussion. Students will compare the Women's History Month (March) to Black History Month (February). Students will brainstorm a list of influential women from history to unlock previous knowledge. Students will then be introduced to the book titles and assembled into small groups. • Students will create a KWL chart. Using All Write Round Robin Structure, students will create the K column stating what they already "know" about their person. Books will then be distributed and they will read the back cover. Using the All Write Round Robin Structure, students will complete the W column of what they "want" to know. Phase 2 Students will be given a copy of their biography to take home and read. They will have four weeks to complete their reading. Each week students will have to create a "Biography Vocab" list of at least 5 words and complete the weekly assignment using those words. Students will also sequence the major events in the text using a timeline. Phase 3 After four weeks of independent reading and weekly assignments, as a whole class discussion, students will be introduced to the project details with the Martin Luther King National Monument in Washington D. C. serving as a model. Students will explore http://www.mlkmemorial.org/ to learn about the mission/vision, location of site and design of the monument. Students will work in collaborative groups to design a monument commemorating the woman they read about. They will present their plan to a selection committee that will have set criteria to evaluate the presentation and plan. Key components of project • Model of the monument • Mission/Vision Statement • Location description and rationale for the site • Multimedia presentation • Oral argument for the selection of this monument proposal

APPENDIX B
RUBRIC

Table B-1. Rubric

	Excellent	Very Good	Good	Fair	Unsatisfactory
Information Skills	Accesses information efficiently and effectively with a high degree of success.	Accesses information efficiently and effectively with a moderate degree of success.	Accesses information efficiently and effectively.	Somewhat unfocused and unclear about how to effectively and efficiently locate needed information.	Student struggles locating needed information.
Thinking and Communication	Demonstrates *in-depth* understanding and insight into the topic through careful analysis and reflection. Ideas are developed and expressed fully and clearly, using many appropriate examples, reasons, details, or explanations.	Demonstrates a *general* understanding of the topic **AND** ideas are generally expressed clearly through adequate use of examples, reasons, details, or explanations.	Demonstrates a *general* understanding of the topic **OR** Ideas are generally expressed clearly through adequate use of examples, reasons, details, or explanations.	Demonstrates *some* understanding of the topic, but with limited analysis and reflection. Ideas are not expressed clearly and examples, reasons, details, and explanations are lacking.	Demonstrates *little* understanding of the topic. Ideas are not expressed clearly or supported.
Creativity	Product shows a large amount of original thought. Ideas are creative and inventive.	Product shows some original thought. Work shows new ideas and insights.	Product shows limited original thought.	Product shows little original thought.	Product shows no original thought.
Technology Tools/Presentation	Uses an extensive variety of technology and presentation tools (programs, software, graphics, video, links, sound, images).	Uses a variety of technology and presentation tools (programs, software, graphics, video, links, sound, images).	Limited use technology and presentation tools (programs, software, graphics, video, links, sound, images).	Little evidence of use of technology and presentation tools.	No use of technology.
Sources	Includes information from *numerous* reputable/reliable/credible sources is used. Sources properly cited.	Includes information from 3-5 credible sources. Sources are properly cited.	Some sources are not credible or are not cited properly.	Some sources are not credible AND sources are not properly cited.	Sources are missing.

APPENDIX C
SAMPLE OF TRANSCRIPT OF TEACHER JOURNAL

Researcher Name: Lisa Marie Holmes
Study Name: PBL Observations
Protocol # 1.;
Observation Date: April 6, 2011
Observation Site: HBMS
Protocol Completion Date: May 1, 2011

Day 2 of students working in groups. All of the drama from yesterday seemed to have subsided. Pretty much chugging along.

AP considered using gaggle docs to do a PP. I asked her why she was going to use gaggle. She said because she didn't have a jump drive with her. I asked her if she had a personal Gmail account. She did. I asked her if she was familiar with Google Docs. She wasn't. I showed her and she was giddy about the possibility of using this application.

AK and LW were having a hard time seeing how all of this was connected. They were feeling like they didn't know what to do. I recapped it for them. I made a bulleted list of what I should expect to see in their presentation. AK wanted to very linearly outline her group's presentation in the order I have the bullets. I challenged her to "wow" the committee. She seemed reluctant to push herself and to think out of the box. She said "I like boring". Confidence issues?

TB is running with the Wordle Idea. Nice transfer of skills. Problem solving to figure out how to insert it into pp. Caught RK, BM and JC playing video games today. They claimed they were done. After a day and a half of a project that was designed to take much longer. I think they were attempting to cut corners.

Sumo paint is a popular application kids are using to sketch their designs and ideas. S some are getting lost in Sumo paint. Almost like wasting time. I am conflicted about them using Sumo paint since it is a distraction but it is a valuable tool for students.

CR is using Mind craft to design his model. He is going to do screen shots to include into his pp presentation.

APPENDIX D
CODING MEMO SAMPLE

		Cooperating
1	LH/1/2/15	Groups all very cooperative
2	LH/1/2/18	working very well together
3	LH/1/5/1	It is interesting to see how groups are delegating the work.
4	LH/1/5/5	Rock, Paper Scissors to define roles.
5	LH/1/5/13	Collaboration is really flying on this. No arguments so far
6	LH/1/5/35	He walked KJ through the process and negotiated with him who was going to do what.
7	LH/1/5/41	JH basically taught him how to do PowerPoint by walking him through the process
8	LH/1/6/25	The groups that worked really well together had a group leader emerge
9	LH/1/8/12	impressive as to how they are all collaborating.
10	LH/1/8/30	KW working hard under the guidance of NC
11	LH/1/9/21	Is a completely a team player and is making wonderful progress,
12	LH/1/10/7	model group
13	LH/1/12/7	Group was cohesive
14	LH/1/6/33	GT demonstrated lots of leadership in this format.
15	LH/1/6/28	SH and KM emerged as leaders in their groups.
16	LH/1/8/13	JS is proving to be a good tutor for LW
17	LH/1/13/11	KJ stepped up as the leader in the group

APPENDIX E
ELKIRE (2007) RUBRIC

Rubric: Elements of 21st Century Lesson Plans

Use this to evaluate lessons you find on the Internet or elsewhere to determine which 21st Century elements they include.
Use this to guide your own lesson planning to include as many relevant 21st Century components as possible.

Name of lesson: _____

URL or source of lesson:

21st Century Topics and Tools:	*Needs Improvement*	*Acceptable*	*Exemplary*
21st Century Content (Check those found) __ Global Awareness __ Financial, Economic, & Business Literacy __ Civic Literacy __ Health & Wellness	Lesson does not target any of the 21st Century content areas.	Lesson targets one of the 21st Century content areas.	Lesson targets two or more of the 21st Century content areas.
21st Century Context (Check those found) __ Content relevant to students' lives __ Bringing world into classroom __ Taking students into the world __ Creating opportunities for interaction and authentic learning experiences	Lesson does not engage students via any 21st Century context/method.	Lesson engages students via one of the 21st Century contexts/methods.	Lesson actively engages students via two or more 21st Century contexts/methods.
Technology Tools (Check those found) __ Information/Communication Technologies (probes, IPods, electronic whiteboards, etc.) __ Audio, video, multimedia, other digital tools __ Access to online learning communities and resources __ Aligned digital content, software, adequate hardware, appropriate tech support.	Lesson does not make effective use of any 21st Century technology tools/techniques to facilitate learning.	Lesson utilizes one of the 21st Century technology tools/techniques effectively to facilitate student learning.	Lesson effectively utilizes several 21st Century technology tools/techniques to facilitate student learning.
21st Century Assessments (Check those found) __ Summative __ Benchmark __ Formative/Classroom	Lesson includes only a summative assessment of learning after the lesson is finished.	Lesson includes at least one formative/classroom assessment which can be used to guide instruction prior to the conclusion of the lesson.	Lesson includes an array of balanced 21st Century authentic assessments for learning to inform and guide instruction throughout the lesson.
21st Century Learning Skills:	***Needs Improvement***	***Acceptable***	***Exemplary***
Information/Communication Skills (Check those found) __ Information/Media Literacy __ Visual Literacy __ Communication Skills	Lesson does little to promote development of any 21st Century information and communication skills.	Lesson promotes some development of one of the 21st Century information and communication skills.	Lesson actively promotes development of multiple 21st Century information and communication skills.
Thinking/Reasoning Skills (Check those found) __ Critical Thinking __ Systems Thinking __ Problem Solving __ Creating and Innovating	Lesson limits the application of higher order thinking/reasoning skills in any of the lesson components.	Lesson encourages the application of one of the higher order thinking/reasoning skills in a component of the lesson.	Lesson strongly encourages the active application of varied higher order thinking/reasoning skills within several of the lesson components.
Personal/Work Place Productivity Skills (Check those found) __ Interpersonal/Collaboration Skills __ Self-Direction __ Adaptability __ Ethical Behavior __ Social/Personal Accountability __ Leadership __ Project Planning/Development	Lesson provides little or no opportunity to practice personal and work place productivity skills during any of the lesson components.	Lesson provides an opportunity to practice one of the personal and work place productivity skills in a component of the lesson.	Lesson provides multiple opportunities to practice several of the personal and work place productivity skills in the lesson components.

Comments about the lesson you reviewed:

What about this lesson do you think needs improved to make it more of a 21st Century lesson?

What aspects of this lesson would you like to incorporate into your own 21st Century lesson plan?

What is your overall rating of this lesson with regard to 21st Century elements?

APPENDIX F
COPY OF PROJECT REQUIREMENTS

Name _____
Period _____
Date _____
Biography Monument Project

By now you should have finished the biography that was assigned to you. Your job now, along with your team, is to design a monument commemorating this person. You will have to put careful thought into the design of monument, location and what your monument will say about the person you read about.

There will be three key elements to your project. You and your group will work collaboratively to bring all three elements together. However, each person will be the "leader" for each section. You should all work together on all of the parts but the leader's job will be to ensure the vision is carried out to the end.

You will present your monument idea to a committee comprised of other 6th grade Academy Students. This committee will only be allowed to give a grant to one group to build their monument. They will use specific criteria to determine which monument presentation should earn the grant. Be sure to refer to the criteria as you work on your monument design.

The Criteria
• To represent a masterpiece of creativity. • To exhibit an important sharing of human values as they were by the person. • To be an outstanding example of a type of monument. • Location is thoughtful and makes sense. • Creative model design and construction. • Persuasive argument for the construction of the monument. • Clear vision presented. • Included explanation of the legacy this person leaves/left behind.

Component	Description	Leader's responsibilities
Persuasive Argument/Proposal	A persuasive argument explaining the vision of the monument. Explain who this person was, why they are important and how this monument commemorates their achievements.	1. Works with other team members to plan the flow of the presentation. 2. Provide information about this person that helps support the vision of the monument. 3. Takes the lead in writing the script and defining the vision.

Design/Model of Monument	A scale model of the monument with a description design elements. Provide a explanation of the location proposed and why your team picked that location.	1. Works with other team members to design and build a scale model out of everyday materials. 2. Provides information about location and design ideas. 3. Provide a rough sketch of the monument design.
Multimedia Presentation	A multimedia presentation that outlines your team's proposed monument and the persuasive argument for why this monument should be chosen.	1. Takes the lead in the creation of a multimedia presentation that supports the team's proposal. 2. Locating information and graphics to include in multimedia presentation. 3. Save presentation in safe location.

You will have three days in the computer lab to research, plan and start working on multimedia presentation.

You will also have access to the laptops each day next week AFTER the FCAT Testing. Your last day of class time to collaborate, create and design in **April 14.**
The project is due April 20. **That is the day you will give your presentation**. You will have a short period of time to touch base with your team on April 19 to make sure all bases are covered.

Please think about the MLK monument we discussed in class as a model of the type of

monument you should be designing.

APPENDIX G
SCREEN SHOTS OF STUDENT PRESENTATIONS

Figure G-1. Screenshot from a Rosa Parks presentation

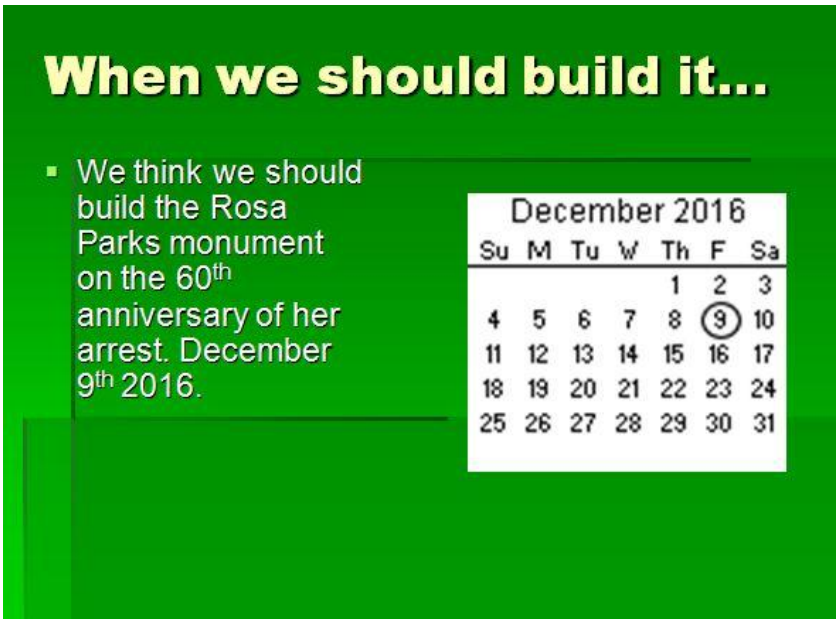


Figure G-2. Screenshot from a Rosa Parks presentation

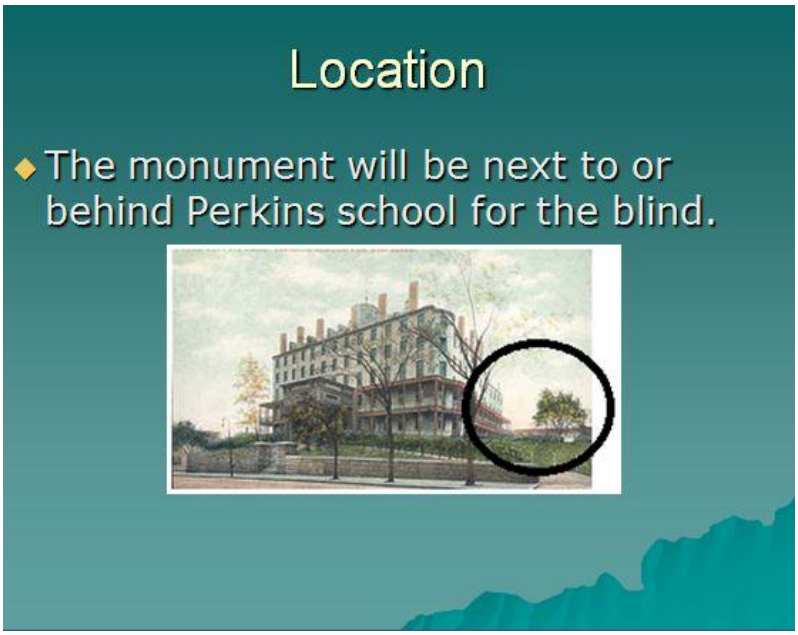


Figure G-3. Screenshot from a Helen Keller presentation

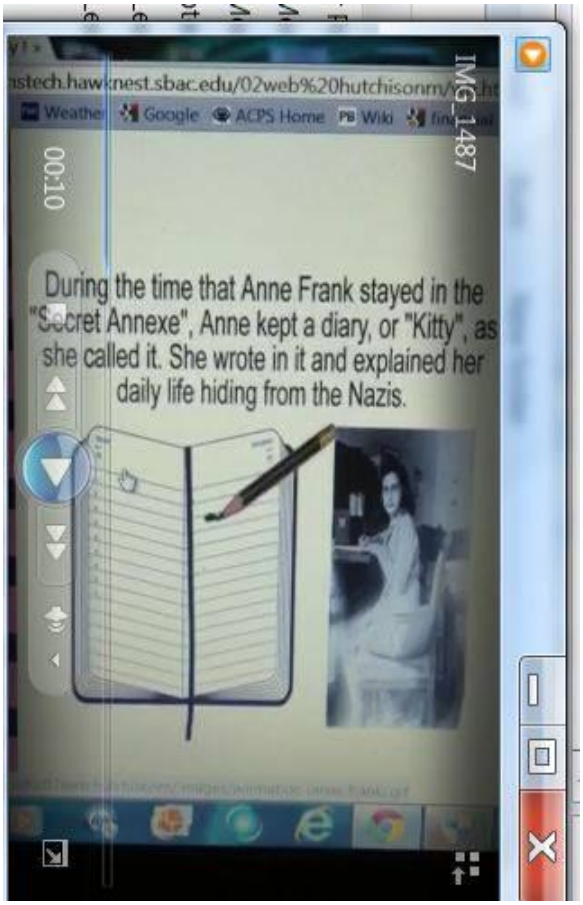


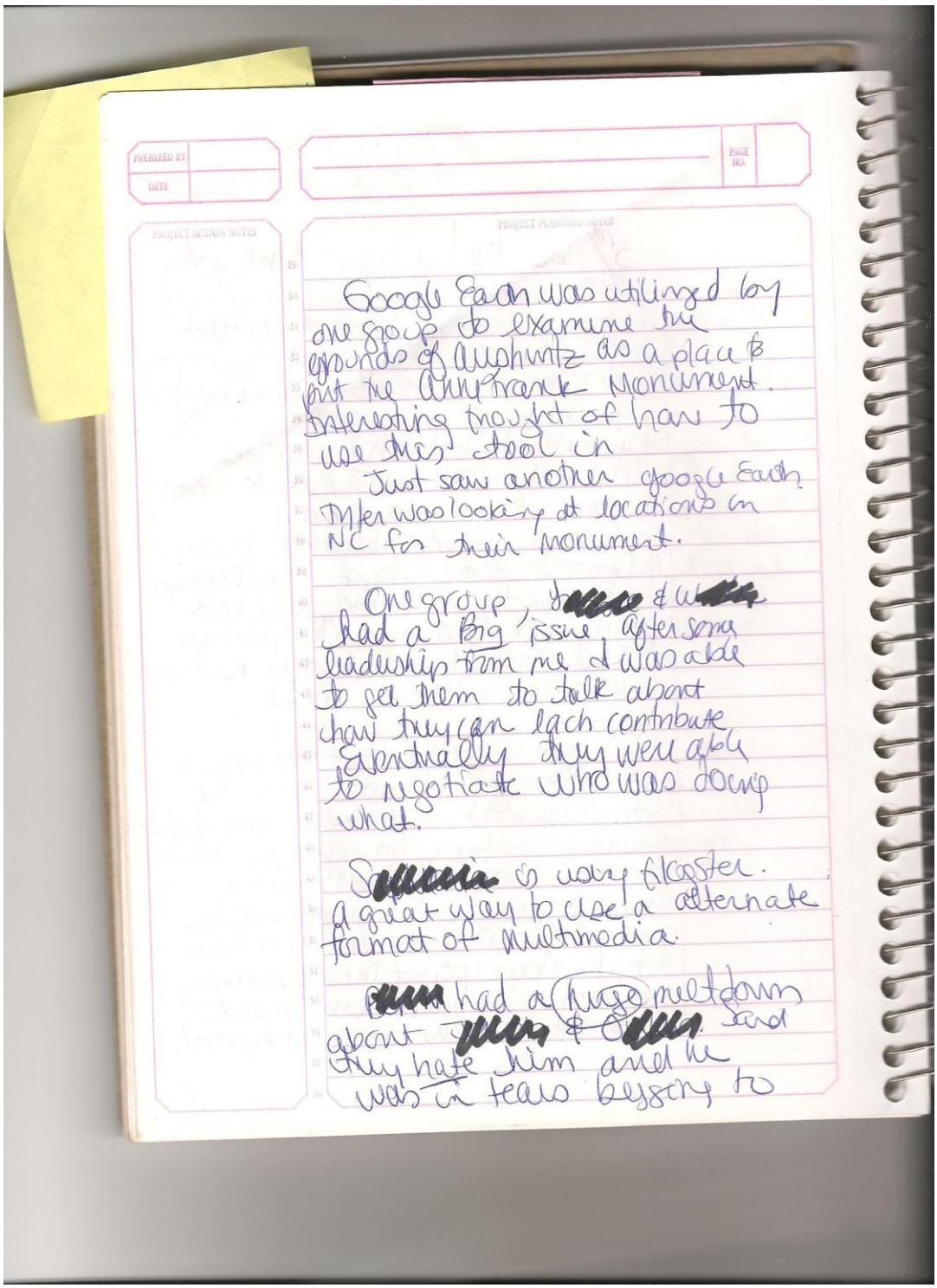
Figure G-4. Screenshot from an Anne Frank Video created as part of a presentation

APPENDIX H
SAMPLE OF RUBRIC COMPLETED BY VALIDATION GROUP

Biography Rubric

	Excellent	Very Good	Good	Fair	Unsatisfactory
Information Skills	Accesses information efficiently and effectively with a high degree of success.	Accesses information efficiently and effectively with a moderate degree of success.	Accesses information efficiently and effectively.	Somewhat unfocused and unclear about how to effectively and efficiently locate needed information.	Student struggles locating needed information.
Thinking and Communication	Demonstrates *in-depth* understanding and insight into the topic through careful analysis and reflection. Ideas are developed and expressed fully and clearly, using many appropriate examples, reasons, details, or explanations.	Demonstrates a *general* understanding of the topic **AND** ideas are generally expressed clearly through adequate use of examples, reasons, details, or explanations.	Demonstrates a *general* understanding of the topic **OR** Ideas are generally expressed clearly through adequate use of examples, reasons, details, or explanations.	Demonstrates *some* understanding of the topic, but with limited analysis and reflection. Ideas are not expressed clearly and examples, reasons, details, and explanations are lacking.	Demonstrates *little* understanding of the topic. Ideas are not expressed clearly or supported.
Creativity	Product shows a large amount of original thought. Ideas are creative and inventive.	Product shows some original thought. Work shows new ideas and insights.	Product shows limited original thought.	Product shows very little original thought.	Product shows no original thought.
Technology Tools/Presentation	Uses an extensive variety of technology and presentation tools (programs, software, graphics, video, links, sound, images).	Uses an extensive variety of technology and presentation tools (programs, software, graphics, video, links, sound, images).	Uses technology and presentation tools (programs, software, graphics, video, links, sound, images)	Limited use of technology and presentation tools.	No use of technology.
Sources	Includes information from *numerous* reputable/reliable/credible sources is used. Sources properly cited.	Includes information from 3-5 credible sources. Sources are properly cited.	Some sources are not credible or are not cited properly.	Some sources are not credible AND sources are not properly cited.	Sources are missing.

APPENDIX I
SAMPLE PAGES FROM TEACHER JOURNAL



PREPARED BY
DATE
PAGE NO.
PROJECT ACTION NOTES
PROJECT PLANNING NOTES

Google Earth was utilized by one group to examine the grounds of Auschwitz as a place for the Anne Frank Monument. Interesting thought of how to use this tool in

Just saw another google Earth. Tyler was looking at locations in NC for their monument.

One group, [redacted] & [redacted] had a Big issue. After some leadership from me I was able to get them to talk about how they can each contribute. Eventually they were able to negotiate who was doing what.

[redacted] is using Glogster. A great way to use a alternate format of multimedia.

[redacted] had a huge meltdown about [redacted] & [redacted]. Said they hate him and he was in tears begging to

PREPARED BY
DATE

PAGE NO.

PROJECT ACTION NOTES

PROJECT PLANNING NOTES

[redacted] wanted to very linearly outline her groups presentation in the order of the bulleted list. I challenged her to "Wow" the committee. She seemed reluctant to push herself out of the box. She said "I don't want to be boring". Confidence issues?

[redacted] really running with Wordle idea. Problem solving trying to figure out how to save it to include in PP.

Caught [redacted], [redacted] & [redacted] playing video games. They claimed they are "done". After a day and a half of a project that is designed to take much longer. I think they were cutting corners. Each got timed out.

Sumo Paint is a popular application the kids are using to sketch their design ideas of how it should work. Some are getting lost in the sumo paint. almost like

LIST OF REFERENCES

Ackermann, E. (2001), *Piaget's Constructivism, Papert's Constructionism: What's the difference?* Retrieved April, 5, 2010, from http://learning.media.mit.edu/content/publications/EA.Piaget%20_%20Papert.pdf

Alachua County Public Schools Foundation (2009) *Foundations for Success.* Retrieved on Jan 30, 2011, from http:/www.acpsf.org/foundation4success.html

Baker, T. R., & White, S. H. (2003). The effects of G.I.S. on students' attitudes, self-efficacy, and achievement in middle school science classrooms. *Journal of Geography, 102*(6), 243-254.

Bandura, A. (1977). *Social Learning Theory*. New York: Prentice Hall.

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *Clearing House: A Journal of Educational Strategies, Issues and Ideas, 83*(2), 39-43.

Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist, 26*(3), 369-398.

Boaler, J. (2002). Learning from teaching: Exploring the relationship between reform curriculum and equity. *Journal for Research in Mathematics Education, 33*(4), 239.

Bransford, J.D. & Stein, B.S. (1993). *The IDEAL problem solver (2nd ed*.). New York: Freeman.

Brown, A. (1997). Designing for learning: What are the essential features of an effective online course*? Australian Journal of Educational Technology Research 13* (2), 115-126.

Brown, D. (2003). Learner centered conditions that ensure students' success in learning. *Education 124* (1), 99-107.

Buck Institute for Education. (2011). Project Based Learning for the 21st Century. Retrieved on Jan 20, 2011, from http://www.bie.org

The Bureau of School Improvement (2006). *Differentiated Accountability.* Retrieved on December 20, 2010, from http://www.flbsi.org

Bynum, W.F. and Porter, R. (eds) (2005). *Oxford Dictionary of Scientific Quotations*. Oxford University Press. 21:9.

Cannings, T. (2003). Online professional development for teachers. *Media & Methods, 39*(4), 14,16.

Carr, T., & Jitendra, A. K. (2000). Using hypermedia and multimedia to promote project-based learning of at-risk high school students. *Intervention in School and Clinic, 36*(1), 40-44.

The Center on Educational Policy (2012). *NCLB/ESEA Waiver Watch.* Retrieved on February 10, 2012, from http://www.cep-dc.org/page.cfm?FloatingPageID=21

The Center for Fair and Open Testing (n.d.). *Fairtest*. Retrieved December 19, 2010, from http://www.fairtest.org/

ChanLin, L. (2008). Technology integration applied to project-based learning in science. *Innovations in Education & Teaching International, 45*(1), 55-65.

Chu, S; Tse, S., Low, E; & Chow, K. (2011). Collaborative inquiry project-based learning: Effects on reading ability and interests*. Library & Information Science Research, 33*(3), 236-243.

Cheng, R. W., Shui-fong Lam, & Chan, J. C. (2008). When high achievers and low achievers work in the same group: The roles of group heterogeneity and processes in project-based learning. *British Journal of Educational Psychology, 78*(2), 205-221.

Clark, A. (2006). Changing classroom practice to include the project approach. *Early Childhood Research & Practice, 8*(2), p. 37-46.

Cochran-Smith, M. & Lytle, S. (1993*). Inside/Outside: Teacher research and knowledge*. New York: Teacher College Press.

Colley, K. (2005). Project based science instruction; Teaching science for understanding. *Radical Pedagogy, 7*(2).

Dana, N.F. & Yendol-Hoppy, D. (2009). *The reflective educator's guide to classroom research*. Thousand Oaks, CA: SAGE Publications.

Dev, P. (1997). Intrinsic motivation and academic achievement: What does their roles imply for classroom teachers*. Remedial and Special Education 18*(1), p. 12-19.

Dewey, J. (1938). *Education and experience*. New York: Simon and Schuster.

Dick, B. (1993). *You want to do an action research thesis? How to conduct and report action research.*Chapel Hill, Qld.: Interchange.

Dick, Bob (2005) *Grounded theory: a thumbnail sketch.* Retrieved April 5, 2011, from http://www.scu.edu.au/schools/gcm/ar/arp/grounded.html

Florida Center for Instructional Technology (2010). *Digital Educators*. Retrieved on December 21, 2010 from http://etc.usf.edu/fde/

Diffily, D. (2002). Project-based learning: Meeting social studies standards and the needs of gifted learners. *Gifted Child Today, 25*(3), 40-3, 59.

Eckes, S. & Swando, J. (2009) Special education subgroups under NCLB: Issues to consider. *Teachers College Record, 111*(11), 2479-2504.

Eisenhart, M., & Towne, L. (2003). Contestation and change in national policy on "scientifically based" education research. *Educational Researcher, 32*(7), 31-38.

Elliott, J. (1991). Action research for educational change. Philadelphia, PA: Open University Press.

Feldman, A., & Minstrel, J. (2000). Action Research as a research methodology for study of teaching and learning science. In Kelly, A.E. & Lesh, R.A. (Eds.), *Handbook of Research Design in Mathematics and Science Education* (pp. 429-455).

Fenci, H. & Scheel, K. (2005). Research and teaching: Engaging students—An examination of the effects of teaching strategies on self-efficacy and course in a physics course. *Journal of College Science Teaching 35*(1), p. 20-24.

Fertig, G. (2008). Using biographies to help young learners understand the causes of historical change and continuity. *The Social Studies, 99*(4), pg 147-54.

Florida Center for Reading Research. (2010). *Florida assessments for instruction in reading.* Retrieved on January 20, 2012, from http://www.fcrr.org/FAIR/index.shtm

Florida Department of Education. (2009). *Florida assessments for reading instruction Technical Manual* (2009-2010 Edition). Tallahassee, Florida.

Filippatou, D. & Kaldi, S. (2010). The effectiveness of project -based learning on pupils with learning difficulties regarding academic performance, group work and motivation. *International Journal of Special Education, 25*(1) p. 10-16.

Gallagher, S.A., W.J. Stepien & H. Rosenthal. (1992). The effects of problem based learning on problem solving. *Gifted Child Quarterly 36*, 195-200.

Geier, R., Blumenfeld, P.C., Marx, R.W., Krajcik, J.S., Fishman, B., Soloway, E., & Clay-Chambers, J. (2008). Standardized test outcomes for students engaged in inquiry-based science curricula in the context of urban reform. *Journal of Research in Science Teaching, 45*(8), 922-939.

The George Lucas Foundation (2011). What Works in Education. Retrieved on January 13, 2011, from http://www.edutopia.org

Glaser, B. G. & Strauss, A. L. (1967*). The discovery of grounded theory: Strategies for qualitative research.* Chicago, Aldine Publishing Company.

Glesne, C. (2006). Becoming qualitative researchers. New York, NY: Pearson.

Grant, M. M. (2002). Getting a grip on project-based learning: Theory, cases and recommendations. *Meridian: A Middle School Computer Technologies Journal*, 5(1).

Grant, M. M., & Branch, R. M. (2005). Project-based learning in a middle school: Tracing abilities through the artifacts of learning. *Journal of Research on Technology in Education,* 38(1), 65.

Gültekin, M. (2005). The effect of project based learning on learning outcomes in the 5th grade social studies course in primary education. *Educational Sciences: Theory & Practice, 5*(2), 548-556.

Harel, J. R., & Papert, S. (Eds.) (1991). *Constructionism.* Norwood, NJ: Ablex.

Hernandez-Ramos, P., & De La Paz, S. (2009). Learning history in middle school by designing multimedia in a project-based learning experience*. Journal of Research on Technology in Education, 42*(2), 151-173.

Herr, K. & Anderson, G.L. (2005). *The action research dissertation: A guide for students and faculty.* Thousand Oaks, CA: SAGE Publications.

Hill, J.R. & Hannafin, M. J. (2001). Teaching and learning in digital environments: The resurgence of resource based learning. *Educational Technology, Research & Development, 49*(3), 37-52.

Hohlfeld, T., Ritzhaupt, A. & Barron, A. Development and validation of the student tool for technology literacy (ST^2L). *Journal of Research on Technology in Education, 42*, (4), 361-389.

Horan, C., Lavaroni, C., & Beldon, P. (1996). *Observations of the Tinker Tech Program students for critical thinking and social participation behaviors.* Novato, CA: Buck Institute for Education.

Kilgore, B. (2001). Biographies and autobiographies: Life models in the classroom. *Understanding Our Gifted, 13*(3), 13-15.

Kucharski, G. A., Rust, J. O., & Ring, T. R. (2005). Evaluation of the ecological, futures, and global (EFG) curriculum: A project based approach. *Education, 125*(4), 652.

Lamb, A. (1998). *Surfing the Internet: Practical ideas from A to Z.* Emporia, KS: Vision to Action Publishing.

Lam, S., Cheng, R. W., & Ma, W. Y. K. (2009). Teacher and student intrinsic motivation in project-based learning. *Instructional Science: An International Journal of the Learning Sciences, 37(*6), 565-578.

Lee, C., & Tsai, F. (2004). Internet project-based learning environment: The effects of thinking styles on learning transfer. *Journal of Computer Assisted Learning, 20(*1), 31-39.

Lehman, J.D, George, M., Buchanan, P. and Rush, M., 2006. Preparing Teachers to Use Problem-centered, Inquiry-based Science: Lessons from a Four-Year Professional Development Project. *The Interdisciplinary Journal of Problem-based Learning*, *1*(1), 76-99.

The Lexile Framework for Reading (2012). *Lexile measures and grade levels.* Retrieved on January 25, 2012, from http://www.lexile.com/about-lexile/grade-equivalent/

Maker, J. C. (1985). *Curriculum development for the gifted*. Rockville, MD: Aspen Systems Corporation.

Maker, J.C. & Nielson, A.B. (1996). *Curriculum development and teaching strategies for gifted learners.* (2nd ed.). Austin, TX: Pro-Ed.

Margolis, J. (2008). *Stuck in the shallow end: Education, race and computing.* Cambridge, MA: Massachusetts Institute of Technology.

McNiff, J. & Whitehead, J. (2006). *All you need to know about action research.* Thousand Oaks, CA: SAGE Publications.

Mioduser, D., & Betzer, N. (2008). The contribution of project-based-learning to high-achievers' acquisition of technological knowledge and skills*. International Journal of Technology and Design Education, 18*(1), 59-77.

Mitchell, S., Foulger, T.S., Wetzel, K. & Rathkey,C. (2009). The negotiated project approach: Project based learning without leaving standards behind*. Early Childhood Education Journal 36*, 339- 346.

Moursund, D. (1999). *Project-based learning using information technology*. Eugene, OR: International Society for Technology in Education.

National Center for Educational Statistics (2011). *Achievement gaps.* Retrieved on Februeary 11, 2012, from http://nces.ed.gov/nationsreportcard/studies/gaps/

Newell, R. J. (2003). *Passion for learning: How project-based learning meets the needs of 21st-century students*. Lanham, Md.: Scarecrow Press.

No Child Left Behind Act of 2001, 20 U.S.C. § 6319 (2008).

Panasan, M. & Nuangchalerm, P. (2010). Learning outcomes of project based and inquiry based learning activities. *Journal of Social Sciences, 6*(2), p. 252-255.

Papert, S. (1980). *Mindstorms : Children, computers, and powerful ideas*. New York: Basic Books.

Partnership for 21st Century Skills (2004). *A Framework for 21st Century Learning*. Retrieved July 6, 2010, from http://www.p21.org/index.php

Pearlman, B.(2006). Students *thrive on cooperation and problem solving*. Retrieved on July 1, 2010, from http://www.edutopia.org/new-skills-new-century

Piaget, J. (1953). *The origins of intelligence in children.* New York, NY: Basic Books.

Powell, S. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education, 130*(2), 241-250.

Riding, P., Fowell, S. & Levy, P. (1995). An action research approach to curriculum development. Information Research 1(1), Retrieved on April 1, 2011 from http://informationr.net/ir/1-1/paper2.html

Saldana, J. (2009). *The coding manual for qualitative researchers*. London: Sage.

Salpeter, J. (2003). 21st century skills: Will our students be prepared? *Technology & Learning, 24*(3), 17-26.

Schon, D. (1983). *The reflective practitioner: How professionals think in action.* New York, NY: Basic Books.

Seo, K., Templeton, R., & Pellegrino, D. (2008). Creating a Ripple Effect: Incorporating Multimedia-Assisted Project-Based Learning in Teacher Education. *Theory Into Practice, 47*(3), 259-265.

Silliman, E.R., & Wilkinson, L.C. (1994). Discourse scaffolds for classroom intervention. In G.P. Wallach & K.G. Butler (Eds.), *Language learning disabilities in school-age children and adolescents.* Boston, MA: Allyn & Bacon.

Solomon, G. (2003). Project-based learning: A primer. *Technology & Learning, 23*(6), 20-2, 24, 26, 28, 30.

Spradley, J. P. (1979), *The ethnographic interview*. Orlando, FL: Harcourt Brace Jovanovich College Publishers.

Strobel, J. & van Barneveld, A. (2008). When is PBL more effective? A meta-synthesis of meta-analyses comparing PBL to conventional classrooms. *Interdisciplinary Journal of Problem-based Learning, 3*(1), 44-58. Retrieved February 18, 2011 from http://docs.lib.purdue.edu/ijpbl/vol3/iss1/4

Thomas, J. W. (2000). *A review of research on project-based learning*. San Rafael, CA: Autodesk Foundation.

Toolin, R. E. (2004). Striking a balance between innovation and standards: A study of teachers implementing project-based approaches to teaching science. *Journal of Science Education and Technology, 13*(2), 179-187.

Vygotsky, L.S. (1962). *Thought and language.* Cambridge, MA: MIT Press.

Vygotsky, L.S. (1978*). Mind in Society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wurding, S., Harr, J., Hugg, R. & Benson, J. (2007). A qualitative study using project based learning in a mainstream middle school. *Improving Schools, 10*(2),150-161.

Yetkiner, Z. E., Anderoglu, H., & Capraro, R. M. (2008). *Research summary: Project-based learning in middle grades mathematics.* Retrieved July 6, 2010, from http://www.nmsa.org/Research/ResearchSummaries/ProjectBasedLearninginMath/tabid/1570/Default.aspx

BIOGRAPHICAL SKETCH

Lisa Marie Holmes obtained her Associate Degree at Villa Maria College in Buffalo, New York, her BS degree in environmental education from Slippery Rock University, her Ed.M in special education from the University of Florida and her Ed.S in curriculum and instruction from the University of Florida. She has worked in public school education at various technology based magnet programs. She also serves as an instructor for teacher endorsement courses for her district.