THE CHALLENGES OF IMPLEMENTING PROJECT-BASED LEARNING IN MIDDLE SCHOOLS

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Project-based learning is an instructional approach that requires teachers and students to work collaboratively to solve authentic problems guided by a driving question and often making use of technology for research and the presentation of findings. This study examined middle school teachers' perceptions associated with the implementation of project-based learning and explored the challenges teachers perceive they face when implementing project-based learning, the ways they respond to these challenges, and the role teachers perceive 21st Century skills play in a project-based learning implementation. The purpose of the study was to examine teachers' perceptions of for consideration of future implementations of project-based learning. The study was conducted at a suburban middle school outside Pittsburgh, PA. Forty-nine teachers responded to a questionnaire designed to collect data on their perceptions. The participants were asked to rate challenges they face against a set list of challenges developed through selected literature on project-based learning implementations (Bender, 2012; Markham, Larmer, & Ravitz, 2003). The participants were also asked to explain ways they respond to the perceived challenges and to rate the degree to which they perceived project-based learning addressed 21st Century skills as defined by the Partnership for 21st Century skills.

The researcher found that teachers perceived that time, meeting state accountability requirements, addressing the standards, implementing the project within the schools schedule

and designing the project-based experience were most challenging when implementing project-based learning. The study also found that teachers either knew how to respond to challenges or expressed further concern about doing so. The 21st Century skills teachers perceived project-based learning addressed more effectively than more traditional methods of instruction were communication and collaboration, creativity and innovation, and critical thinking and problem solving.

The findings suggest that professional development may help alleviate some of the perceived challenges teachers face when implementing project-based learning. The study also suggests that 21st Century skills play a valuable role in project-based learning implementations and should be specifically addressed in the development and implementation of project-based learning experiences.

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1.0 INTRODUCTION

Educators have long seen the value of placing students in real-life scenarios to help them gain deeper levels of understanding of learning (Boss, 2012; Markham, 2011). Likewise, educators have long understood the value of projects as a means to help students learn new concepts. However, project-based learning is more than just "doing projects" as much as it is more than a simple "real-life" experiential activity (Markham, 2011). Project-based learning is currently experiencing a resurgence of interest in K-12 schools across the country based upon a need to educate them in response to changes in global industries requiring different skills from the global workforce (Gut, 2011; Markham, 2011). There are many who see project-based learning not as a mere classroom instructional strategy, but as the means to redirect the instructional approach to teach the skills needed to prepare students for the modern global economy (Bell, 2010; Gut, 2011; Markham, 2011; Stanley, 2012). As this resurgence progresses and teachers in K-12 schools experiment with project-based learning and begin to implement the practice, the challenges of doing so become a topic of some interest. The purpose of this research is to investigate how teachers perceive the challenges of implementing project-based learning, how they respond to these challenges and, since 21st Century skills are so important in modern education, society and industry, how they perceive the specific roll technology plays in the implementation of project-based learning. The study may help teachers better understand how to implement project-based learning in response to the changing needs of a global society.

1.1 THE PURPOSE AND ORGANIZATION OF CHAPTER 1

This section includes why the study of the challenges of project-based learning is important to the field and to me, including what brought me to the study of project-based learning. The section also includes the intent of the study, the research questions and glossary of terms and the limitations of the study.

1.2 WHY IS THE STUDY OF THE CHALLENGES OF IMPLEMENTING PROJECT-BASED LEARNING SIGNIFICANT?

America has always identified itself as a nation of innovators, personified by founding fathers like Ben Franklin and images like the key and kite or Thomas Edison and the light bulb. The day Sputnik was heard beeping across the sky turned this innovative ethos into an innovative competiveness leading to the Space Race, the capstone of which was Neil Armstrong landing on the moon (Semeniuk, 2007; Telzrow & Welch, 2007). Not only was there a fear the Russians would dominate America, but there was also a fear our educational system was not up to the challenge of beating them. The National Defense Education Act of 1958 helped build purpose behind an educational system intent on producing innovators particularly in mathematics and the sciences (Flynn, 1995a; Friel, 2005; Powell, 2007; Telzrow & Welch, 2007).

But in just twenty or thirty years there was an indication that American competitiveness was waning. In 1983, *A Nation at Risk: The Imperative for Educational Reform* was published and reported a very different nation of young people unlike their grandfathers who responded to the builders of Sputnik by landing on the moon. The report described the dire details of a

nation's educational system that had dangerously fallen behind other countries. The authors of the report did not gently address the matter.

> If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves. We have even squandered the gains in student achievement made in the wake of the Sputnik challenge. Moreover, we have dismantled essential support systems, which helped make those gains possible. We have, in effect, been committing an act of unthinking, unilateral educational disarmament (US Department of Education, 1983).

Some of the supporting data was chilling – with illiteracy among 17 year olds at 13% and among minorities, as high as 40%. Overall, SAT scores had seen a steady decline since the 1960s. Achievement scores in other areas were also in decline, including science, which saw steady decline on national assessments since 1969 (p. 11). To address these problems, the authors called for changes so that schools could "respond to the challenges of a rapidly changing world" (p. 14).

One of the responses to follow was the institution of educational standards spawned by laws like the *Elementary and Secondary Education Act of 1965* and its reauthorizations. The *Elementary and Secondary Education Act of 1965* included six titles to address various needs in American schools. Title I provided funding for the education of low-income children, Title II provided funding for resources, Title III provided matching grants for supplementary education centers, Title IV provided funding for educational research and training, Title V provided grants to strengthen states' departments of education, and Title VI provided funding for other general provisions. The original law has gone through several "reauthorizations" add to and further clarify its provisions. In 1967, Title VII was added to provide funding for bi-lingual education. Following reauthorizations required states to establish content and performance based standards

and match testing to these standards (Barton, 2001). One well-known reauthorization, President George Bush's No Child Left Behind reauthorization of 2001, brought forth unprecedented accountability in education ("Elementary and Secondary Education Act of 1965," 2009). More recently, a collaboration of states' governor and a council of chief state school officers developed The Common Core State Standards to promote rigorous content and application of skills and prepare them for success in college after high school and for careers and compete globally (Common Core State Standards Initiative, 2010).

And there is reason for such global competitive concern. In 2012 the Program for International Student Assessment (PISA), which measures the performance of 15-year olds in mathematics, reading literacy and science across 34 member countries, revealed some concerns for U.S. students. The U.S. average score was below the average score of the member countries in mathematics and not measurably different than the average score of the member countries in reading literacy and science. (National Center for Educational Statistics, n.d.).

The challenge to be a nation of innovators and the desire to be the best globally remains. After the second A Nation at Risk report was published (US Department of Education, 2008) showing the circumstances for the American educational system hardly improved, the impetus for educational programs, concepts, constructs and approaches that help address those areas is growing. Like the efforts following the frenzy after Sputnik and the *National Defense Education Act of 1958* that promoted mathematics and science, current educational efforts to address similar concerns raised by Sputnik are captured in the STEM (Science, Technology, Engineering and Mathematics) or STEAM (add the Arts) or STREAM (add Research). The purpose behind these acronyms is an effort to prepare students for a different kind of workplace, one steeped in 21st Century skills. The Partnership for 21st Century Skills includes a well-recognized framework of

skills needed for the modern work force (Partnership for 21st Century Skills, 2011). The learning and innovation skills of Creativity and innovation, Critical thinking and problem-solving, Communication, and Collaboration are some of the skills addressed in the framework. In fact, these skills, along with inquiry-based approach to instruction and problem solving, are showing up in more kinds of curricula. The new advanced placement chemistry curriculum, for instance, has been rewritten to include more of these types of skills and processes (College Board, n.d.-b).

Recently, the state of West Virginia completed a study where they looked at the connection between 21st Century Skills and project-based learning. This study, like others, shows a correlation between the two. Because of the way in which project-based learning is designed, students experience the types of skills both A Nation at Risk reports claim American students need to pursue in order to catch up to international counterparts. If project-based learning has the potential to help American student tap into the skills they need in order to be successful and competitive globally, then it is a significant topic of study.

Project-based learning involves a very different construct. Teachers are asked to move the focus of the learning from the front of the room. Students move out of rows and into groups, often assigned to specific roles. The curricula, though based upon the standards, is not artificial but is based upon something authentic and maybe even real-time. Students often have a choice in what they will do and the question they will investigate (Bender, 2012; Larmer & Mergendoller, 2010; Markham, Larmer, & Ravitz, 2003; Solomon, 2003). Because of these fundamental differences, project-based learning breaks from the traditional teacher-in-front, students-in-rows model of teaching and learning. In some cases, entire schools are set up to run this way (Weinbaum et al., 1996). The significance of a model that finally breaks the old

teacher-in-front, students-in-rows traditional educational paradigm cannot be understated and should be studied.

1.2.1 What Brought Me to this Study?

The pedagogical ideas behind project-based learning have followed me for most of my career as an educator. In 1991, when I was accepted into the Masters of Arts in Teaching program at the University of Pittsburgh, I was lucky enough to be placed with a mentor teacher who was a master at implementing cooperative learning – an approach that structured collaborative learning of a group of students where each member of the group is assigned a specific role and task in order to accomplish a group goal (R. T. Johnson & Johnson, 1999). This was a decidedly different approach to the more traditional approach to teaching where students stayed in rows and received the same assignment and individually completed them. These early experiences became a formative pedagogical framework within which a belief system about teaching and learning was built.

Later in my career, as a young new teacher, my district was interested in an approach called "Continuous Progress Instruction" where students were pre-tested and then prescribed a specific set of activities often in the form of learning stations in order to best address their specific learning needs. My version of this was to pretest my language arts students and design specific reading and writing activities identified through symbols. Students would follow the symbol that matched how they pretested and work in symbol groups accordingly. Students would move in and out of symbol groups each pretest depending on how they performed. This kind of experimentation was based upon my earliest experiences with my mentor teacher who

showed me a system where students could learn together in structured groups with defined roles and tasks.

During this early time in my career I was also working on a team of teachers at a middle school – each team representing a content area and teaching the same group of students. In the middle school, I experienced thematic units and learned that knowledge is really not categorized into subjects like they are in most schools where students move from one class to another like moving down an assembly line in a factory. In the middle school, I learned the value of constructing learning experiences for students based upon big ideas and concepts and the idea that students construct meaning from specific learning experiences rather than teachers giving it to them through lecture. It was probably in these earliest teaching experiences where I came to believe that students learn from deep inquiry or working with other students to solve hard problems or from multiple attempts to get an answer.

During all of this instructional exploration, I was intensely interested in the role of technology in the classroom. Thankfully, the district in which I worked had the resources and the belief to invest in hardware and software for teachers and students throughout the years. As my exploration of non-traditional teaching continued, as I have been describing, I could see the vital role technology plays in student learning and I became interested more in what was coined as "21st Century skills" or those skills necessary for students to be successful in a modern world. The Partnership for 21st Century Skills was an authority for clearly communicating and promoting the concept (Parntership for 21st Century Skills, n.d.).

All of these learning beliefs have followed me in one way or another and recently have manifested themselves in what the literature calls project-based learning. My interest in this learning initiative rests in how well it seems to embody so much of what I believe to be true

about teaching and learning. I wonder if it is where the future of education will lead and if it is a good idea for it to do so. Though this is a larger question and beyond my ability to answer, it is what drew me to the topic.

1.2.2 Intent of the Study

There is literature available to support educators who are interested in implementing project-based learning including resources that guide teachers in constructing units and assessing students (Markham, et al., 2003; Stanley, 2012). There is also modest literature available that addresses the efficacy of project-based learning compared to other modes of instructional practice (Boaler, 1998b; Thomas, 2000). However, there are few studies that explore the experience of teachers implementing project-based learning. In particular, there are very few studies exploring the challenges teachers face when implementing project-based learning. Studies in this area could potentially be helpful to teachers if, indeed, project-based learning is gaining in popularity as an instructional approach more suited to teach to the concerns of the modern world.

Implementing project-based learning involves a dramatic departure from traditional modes of teaching (Bender, 2012), thus, a teacher used to that style of teaching would undergo some degree of awareness of difference between their past teaching practices and the new approach with project-based learning. The intent, then, of this study is to explore the space where implementation happens and where teachers' old approaches encounter a new philosophy and how they respond to the challenges of this new approach. The results of such a study might provide future implementers of project-based learning with answers to common challenges associated with implementing the approach. Specific to the context of the site in which the study

is being conducted, the results might help inform future decisions regarding how to design professional development in project-based learning based upon the results of the study.

Since 21st Century skills are commonly associated with project-based learning (Bell, 2010; Bradford, 2005), the study also intends to explore the role 21st Century skills play in the implementation of project-based learning. Specifically, the study will explore how effectively teachers feel project-based learning teaches 21st Century skills as compared to their past teaching practices.

It is not the intent of this study to explore the efficacy of project-based learning as an instructional strategy compared to other kinds of instructional approaches. Though it would be interesting to do such a study, it is beyond of the scope at this time to conduct a study involving students under the age of 18 years old. If such a study were to be conducted, it would be interesting to examine a group of students who followed a project-based learning curriculum compared to a group of students who did not, using for instance, a state or national test and a growth metric if possible, that is, two administrations of the test to measure growth over time. However, before such a study should be conducted, teachers need to understand viable means of implementation of project-based learning and in order to do that, they need information on the challenges they will face as they move from current practice as they know it into new practice as it is defined in project-based learning.

1.2.3 Research Questions

The following research questions are designed to guide the exploration of the teachers' perceptions when implementing project-based learning. Specifically, the questions facilitate the exploration of the challenges teachers perceive they face when implementing project-based

learning, how they respond to these challenges and the role 21st Century skills have in project-based learning implementations. The questions will also guide an analysis of the results by allowing the researcher to determine what challenges are most and least impacting on teachers' perceptions. An analysis through the questions will also allow the researcher to determine the ways teachers respond to these challenges as well as the extent to which teachers perceive project-based learning as a means to address 21st Century skills. The results derived by a study of these questions could help inform future implementations of project-based learning.

Research Questions:

1. What challenges do teachers perceive they face when implementing project-based Learning?
2. What ways do teachers respond to these challenges?
3. What are teachers' perceptions about project-based learning as a way to teach 21st Century skills?

1.2.4 Glossary of Terms

There are several terms used throughout the study that, when defined, will help the reader understand and interpret the study. The glossary below is provided for this purpose.

21st Century skills – 21st Century skills are skills students need in order to be successful in the modern workforce. The Partnership for 21st Century Skills (Partnership for 21st Century Skills, 2011) has developed a framework that defines these skills in several components including the learning and innovation skills, specifically creativity and innovation, critical thinking and problem-solving, communication, and collaboration; life and career skills; and information media and technology skills.

Common Core State Standards – The Common Core State Standards details what students in K-12 schools should know and be able to do in Math and English Language Arts as

well as establishes college and career readiness standards. The initiative began in 2009 sponsored by the National Governors Association and the Council of Chief State School Officers with the goal to set consistent, rigorous standards across states (Common Core State Standards Initiative, n.d.).

Inquiry – Inquiry is an instructional approach often associated with science though gaining use in other content areas, where students are engaged in in-depth research of a topic with the purpose of answering a question, solving a problem or deriving a hypothesis.

No Child Left Behind – No Child Left Behind of 2001 was that year's reauthorization of the Elementary and Secondary Education Act. No Child Left Behind instituted unprecedented accountability requirements.

Project-based Learning – project-based learning is an educational approach that places students in an authentic problem scenario where they work in a team using problem-solving and research skills to find solutions. A driving question guides the multi-disciplinary inquiry, as does the teacher who serves as facilitator and advisor. Often, real experts from the field are asked to present or share information and technology tends to be a valuable tool in the learning process (Barell, 2010; Bender, 2012; Larmer, 2009).

Problem-based Learning – Problem-based Learning, though similar to project-based learning, typically involves one content area (as opposed to several in project-based learning). The approach comes out of the medical tradition and because of this may mean the learning experience has specific, prescribed steps or looks for a specific solution (Larmer, 2013; Neufeld & Barrows, 1974).

1.2.5 Organization of the Chapters

Subsequent chapters of this dissertation address a review of literature of project-based learning, the methodology and methods used to conduct the study, findings and results of the study and, finally, a discussion and implications of the study. The review of literature (chapter 2) will cover the discourse concerning the definition of project-based learning, which is malleable given the context and also interesting to explore in light of project-based learning's close cousin – Problem-based Learning. The review of literature will cover the authors' discourse on the efficacy of project-based learning as an instructional approach as well as the historical beginnings of project-based learning to its current resurgence of interest. The chapter will also explore the discourse concerning the study of implementations to see what researchers have found regarding the challenges associated with implementing new innovations in schools. Chapter three follows with details about the research methodology, the background and setting, information on the participant population, the data collection procedures through the questionnaire, and the methods for analyzing the data. Chapter four reviews the findings of the study, organizing the challenges, the teachers' responses to the challenges and their responses to the questions regarding 21st Century skills. Chapter five concludes the dissertation with implications of the study and recommendations for further research.

2.0 REVIEW OF LITERATURE

As Foss and Waters (2007) write, "working out the categories of literature to cover in your literature review is not hard to do because the categories come directly from the terms of your research questions" (p. 54). For the purposes of this dissertation, the literature selected will delve into the discourse surrounding the varied definitions of project-based learning including its theoretical and historical beginnings, a modest look at discourse on the implementation literature, the research behind the efficacy of project-based learning in K-12 schools and the connection project-based learning has to 21st Century skills. Each of these topics is essential to understand the dissertation study context, results, interpretation and discussion.

2.1 THE DISCOURSE ON DEFINING PROJECT-BASED LEARNING

It is not long before a study of selected literature will reveal widely varied definitions of project-based learning. In fact, authors have discussed how difficult it is to study project-based learning due to the variability of its design and implementation (David, 2008; Thomas, 2000). Teachers can set up a project-based experience to last a day or weeks, cover one standard or many, a variety of skills, a variety of disciplines for a variety of purposes. Other terms are used to capture similar approaches to project-based learning. Science programs, for instance, are embracing "inquiry-based learning," as a means to engage students in scientific method. Apple

Computer is interested in "challenged-based learning," where students leverage technology to solve real-world problems of high interest to them. Additionally, students have engaged in "problem-based learning" where a problem context drives the learning – an idea formalized at McMaster University to teach medical students. (Alsop-Cotton, 2009a; Barell, 2010; L. Johnson, Adams, & Consortium, 2011; Neufeld & Barrows, 1974; Shih, Chuang, & Hwang, 2010). However, despite the variability in definition, selected literature supports a theoretical foundation and key elements that forms a consistent definition.

2.1.1 The Historical and Theoretical Beginnings of Project-based Learning

Fairly early in the 20th Century, John Dewey wrote extensively about the impact of experience on learning in *Experience and Education* (1938). His work on the impact of experience on a child's education is foundational to the formation of project-based learning, as we know it today. Dewey's work focused on a theory of experience that challenged both traditional and progressive forms of education. However, he posited that not all experience was actually educationally valuable; it could be "miseducative" if it was not structured appropriately (p. 25). This structure was based upon the interaction of two founding principals of experience: continuity and interaction (p. 10). Continuity states that all experiences are carried forward and influence all future experiences (p. 35) and interaction refers to the internal conditions of an experience (p. 42). These principles become the framework upon which the educator makes judgments as to the value of an educational experience. The educator has to ensure that the surroundings are conducive to moving the experience forward.

Project-based learning is a practical expression of Dewey's philosophy. In the approach, teachers work with students to design an authentic experience. There is enough freedom for

students to build understanding without direct teacher instruction, yet standards and the teacher guide students. To place this in the context of Dewey's work, project-based learning would challenge traditional education yet not be formless like progressive schools, as Dewey says, plagued with excessive individualism and spontaneity (p. 10).

In chapter four of *Experience and Education*, Dewey (1938) explores the development of experience through interaction as a construct of social control (pp. 51-59). Project-based learning is, in essence, a structured social interactive experience where students work collaboratively often in pre-defined roles to solve a problem or accomplish a task. Dewey (1938) writes, "The principle that development of experience comes about through interaction means that education is essentially a social process (International Centre for Educators' Learning Styles, 2014). This quality is realized in the degree in which individuals form a community group" (Dewey, 1938 p. 58). Project-based learning provides a process framework within which a designed social experience takes place (Bender, 2012; Larmer & Mergendoller, 2010; Larmer, 2009).

Given all the theoretical connections to Dewey, it's no wonder his work is so commonly mentioned in the literature concerning project-based learning (Alsop-Cotton, 2009b; Barron et al., 1998; Bell, 2010; Drake & Long, 2009; Larmer, 2013; Summers & Dickinson, 2012). Beyond Dewey, Jean Piaget's work on how children build knowledge of the world around them provided more theoretical validation for project-based learning (Piaget, 1973). According to Piaget's work, children come to understand the world by undergoing several stages of development and do so by being actively engaged with their environment. Educators have used Piaget's work as the basis for creating discovery-based curricula where students learn by doing

and exploring and skills are discovered rather than taught at the appropriate stage of development (McLeod, 2009).

Lev Vygotsky's studies of description of the circumstances under which students learn best is yet another theoretical framework for project-based learning. Vygotsky defined the *Zone of Proximal Development* as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotskiĭ & Cole, 1978 p. 86). Project-based learning is specifically designed to place the teacher in a facilitator role and students in collaborative groups in problem-solving situations; thus, it is possible to see project-based learning as the vehicle through which Vygotsky's Zone of Proximal Development is realized.

2.1.2 What the Literature says about Implementation

The 1960s saw an unprecedented amount of curricular implementations and educational experimentation and followed by research on how teachers react to implementation in the 1970s (M. G. Fullan, 1990). From the study of implementation, researchers developed structures to begin to organize and explain the effect of implementation in schools. Often these structures were described in terms of "stages" (George, Hall, Stiegelbauer, & Laboratory, 2006) or "phases" (Vrakking, 1995) to describe the process by which a teacher begins to adopt a new practice or innovation.

As implementation began to become more thoroughly studied (M. Fullan & Pomfret, 1977; M. Fullan, 1983; Hunkins & Ornstein, 1989; Leithwood & Montgomery, 1980; Roberts-Gray, 1985), various tools were developed to examine the psychological effect of

implementation. Out of the Research and Development Center for Teacher Education and the work of Fuller (1969) followed by Hall, Wallace, & Dossett (1973) came the Concerns-Based Adoption Model (CBAM), which "is a conceptual framework that describes, explains, and predicts probable behaviors throughout the change process…" (George et al., 2006 p. 5). A questionnaire was developed out this framework to measure the seven stages of concern as identified in the model (p. 11). The model and the questionnaire helped researchers and educators understand the complex process associated when individuals are asked to adopt an innovation. The results of the questionnaire can be used to develop professional development through a detailed examination of the levels of concerns teachers face when implementing an educational approach, strategy, curriculum, etc. (George et al., 2006 p. 61-63). Though the CBAM model is not the only model that describes the change process (Vrakking, 1995), it is one that focuses on barriers teachers face in the form of "concerns" when implementing an innovation. The model give indication of the psychological effect associated with adopting and innovation at various stages and how a teacher's stage of concern can indicate a particular behavior.

Discussion of "behavior" is prevalent in the literature about implementation. Words like "denial," "acceptance," "worry," "concern," and "resistance" all appear in reference literature associated with the study of implementation (M. Fullan & Pomfret, 1977; Hunkins & Ornstein, 1989; Kwok, 2014; Vrakking, 1995). Fullan & Pomfret (1977) wrote about behavior in terms of the role change that occurs with the teacher-student relationship when adopting and innovation. The authors identify this relationship change as a potential cause of problems because implementation plans do not often explicitly address them (p. 337). They highlight the relationship change writing that, "Teachers must think of students as being potentially capable of

desiring, needing, and exercising more autonomy" and that, "students must think of teachers more as guides than as directors of learning" (p. 338). Of the possible indicators of change, they write of teachers adopting new teaching techniques that allow for "experiential and peer-based learning situations…" illustrating that the relationship and role change cannot be separated from the curricular change (p. 338). This characterization is not unlike the description of what is involved in implementing project-based learning where teachers move from front of the class to the role of facilitator and students out of rows and into groups to delve into some authentic inquiry (Bender, 2012; Markham, et al., 2003).

Hunkins and Ornstein (1989) write of the need for leaders to be cognizant of the barriers to change (p. 110-111). The barriers stem from a basic feeling that it is easier to keep the status quo or the change will eventually lead to more work. The authors call this barrier "inertia" as a way to describe the effect of people who do not move because they are avoiding the pain associated with changing what they know. The authors also address how teachers can become "innovation shy" if they have been around long enough to see short-lived innovations come and go or feel they can wait them out and how ignorance can be a barrier if the rationale and purpose of an innovation has not been fully explained to the implementers (p. 111). All of these barriers can lead teachers to resist change. The literature about implementation and, more specifically, the barriers teachers face when they implement an innovation are helpful to this study in that they help provide a foundational understanding of what general effects occur when people undergo change. Though beyond the scope of this study, it would be interesting to compare the results of stages or phases of implementation study similar to the CBAM study, for instance, and match these to the specific concerns of implementing project-based learning in this study. Are

there correlations between a particular CBAM stage of concern and a particular project-based learning implementation challenge, for instance?

2.1.3 Early Application of Project-based Learning

An early precursor of project-based learning began as a new way to teach medical students. Coined "The McMaster Philosophy" a close cousin of project-based learning, "problem-based learning" emphasized learning individually or in groups based on problems rather than on blocks of classified knowledge in lecture-style classrooms. It focused on frequent "formative" evaluations of the student's learning progress and emphasized an integration of departments – a challenge for the professors as much as it was the students (Neufeld & Barrows, 1974). Problem-based learning continued on in medicine and the sciences as evidenced in the literature (Antić & Spasić, 2012; Gugliucci & Weiner, 2013; Learning & Development, 1969; Weßel & Spreckelsen, 2009).

Historically, the definition of project-based learning has evolved. The chart below shows some of the authors, time frame of work and descriptors in relation to project-based learning or elements of concepts related to this approach to help highlight the historical evolution.

Table 1 - Authors Associated with the Theory and History of Project-based Learning

Author	Time Frame	Descriptor
Dewey	1938	Connection to experience and the quality of education
Piaget	1973	Children construct an understanding of the world around them

Table 1 Continued

Neufeld & Barrows	1974	"McMaster Philosophy" – a new approach to teaching medical students where students are presented with open problems they must work with others to solve. It was a decidedly different approach from a traditional lecture and test style of education.
Vygotsky	1978	Project-based learning can place students in a "zone of proximal development"
Markham, Larmer, Ravitz	2003	Comprehensive work on project based Learning through the Buck Institute for Education
Barell	2010	Work on Problem-based Learning capturing many parallels to project-based learning and connecting concepts within both to 21st Century learning
Bender	2012	Supplying a full modern definition of project-based learning in light of 21st Century learning and education issues
Larmer & Mergendoller	2012	Project-based learning in the context of the Common Core State Standards

Source: Created by the author

2.1.4 Project-based Learning and Problem-based Learning

Project-based learning is the focus of this review and the study to follow because it the more prevalent approach in K-12 schools (Bender, 2012), whereas problem-based learning has more of a connection to medical educational programs (Antić & Spasić, 2012; Neufeld &

Barrows, 1974; Weßel & Spreckelsen, 2009). However, the difference between project-based learning and problem-based learning can be an area of some confusion for early implementers of either approach. The definitions can be blurred between the two. Authors like Markham, Larmer and Ravitz, (2003), differentiate *project-based learning* from *problem*-based learning by describing the former as "an instructional method that uses projects as the central focus of instruction in a variety of disciplines…" that may "…unfold in unexpected ways" and the later - "problem-based learning" – as an instructional approach where students move "along a more carefully planned path toward a set of prescribed outcomes" (Markham et al., 2003 p. xi).

The following chart may help clarify some of the differences and similarities between Project-based and Problem-based Learning.

Table 2 - Project-based learning and Problem-based Learning

Project-based Learning	Problem-based Learning	Differences
• Driving question • Collaboration • Student choice • Multiple disciplines/subjects • Skill-focused • End presentation	• Open problem • Team approach • Authentic scenario • Standards or content-focused • Solution presentation	• Project-based learning involves more student choice in direction • Problem-based learning is often more content or standards focused • Project-based learning focuses on the skills in the process as much as the end product • Problem-based Learning focuses specifically on using team work to identify and find a solution to a problem

Source: Created by the author

2.1.5 Elements of Project-based Learning

At its most fundamental level, project-based learning provides students the context within which to construct meaning and to learn content through completing a task that is important to them (Bell, 2010; Bender, 2012).

Though definitions vary, project-based learning often involves the following key components and are arguably a good working, modern definition of project-based learning (Barell, 2010; Bender, 2012; Larmer & Mergendoller, 2010; Markham, 2011).

In most project-based learning, students engage in a true-to-life or real life situation where the purpose of the learning is clearly evident. In the best cases, the topic is of particular interest to the age of the students completing the work. If the situation allows, the project is one that can make an impact outside of the classroom. In the best project-based learning experiences, students engage in an authentic context – a local water problem, a political situation facing children, a what-if energy or health crisis – to energize the students and illicit their interest. As a part of this authentic experience, some projects will require contact with outside experts in the field in order to complete specific parts of the project or answer questions that were generated along the way (Anderson, 2010).

In project-based learning, the flow of knowledge moves away from the teacher to the students. The students become the conduit of information and the teacher serves as the facilitator of the learning experience as well as content advisor if not the content expert, guiding the students in their exploration, innovation, research and synthesis. It is a decidedly different approach than traditional models where the teacher is seen as the deliverer and vessel of all knowledge. In a project-based classroom, knowledge can be found in multiple sources – books, teachers, outside experts, the Internet and each other.

A project-based learning experience worth doing is one that seeks answers to important questions. These questions spark interest, debate, consternation, excitement but no real absolute answers. The heart of a project-based learning experience is a question with enough substance that allows for considerable research and meaningful and rigorous academic study – reflective of academic standards. The question is one of interest to the students or that the students help choose. Inquiry must be at the heart of the project-based learning experience. As John Barell (2008) succinctly puts it, "when we are curious, ask questions, and seek to find answers, we, at some point along this journey, begin to think critically. We will find information that we need to analyze, compare/contrast, determine reliability, and draw reasonable conclusions…." (p. 23).

Most school systems are still organized into segmented courses based upon a 19th Century factory model despite the fact that we now know that we need citizens who can think differently and for different reasons (Leland & Kasten, 2002). Since project-based learning experiences revolve around a central problem or driving question there is an opportunity, often a need for student to pull in multiple content areas to solve the problem. Though students may need to use certain technical skills in one part of the project, they may need a completely different set when they prepare to present the final findings or product (Anderson, 2010).

The degree of student ownership in the learning is a hallmark of project-based learning. This often begins with student involvement in helping to choose the purpose, direction and guiding questions for the project. The degree to which students will have a voice in these things will depend upon a great many factors including the length and scope of the project, the students' ages and the teacher's and students' past experiences with project-based learning. Regardless, project-based learning involves some degree of student voice to promote student ownership and focus (Bender, 2012; Markham et al., 2003).

A project-based learning experience creates a natural context for the use of technology. Students who are engaged in inquiry need to have questions answered. They desire ready access to real and accurate information. They need tools to organize data, brainstorm solutions, innovate, collaborate with each other within the classroom and others outside of the classroom Technology can uniquely address these needs in the project-based learning classroom (Bell, 2010).

Project-based learning requires that students work together to solve a problem or address a situation. Typically, the experience will come with it roles that are reflective of those found in the real world (Anderson, 2010).

Most work that is produced is presented in one manner or another. In the case of a project-based experience, the presentation is not the add-on at the end of the learning, but often a necessary step where a team of students must share their findings to a panel of experts before a solution is chosen. The presentation is the natural extension of the experience (Bender, 2012).

2.1.5.1 Project-based Learning and Standards

The idea in project-based learning is that the students will have more thoroughly learned content knowledge far beyond what they learn solely derived from rote memorization and repetition. Thom Markham (2003) identifies project-based learning as "*central* rather than *peripheral* to the curriculum" (Markham et al., 2003, p. 4). The intense focus on standards and the idea that the project is the driving force of the learning rather than an add-on after some other learning, promotes the college and career readiness standards of the Common Core State Standards. In fact, there are many such links between the goals of these standards and project-based learning (Larmer & Mergendoller, 2012). The process the students follow in project-based learning experiences where they work together each with a defined role to play in order to help

solve the problem or accomplish the task, more closely mimics the real-world workplace (David, 2008).

In the past, teachers would often schedule projects as an assessment product at the end of the other learning activities and were not necessarily standards-based or, if they were, it was an accident that the project happened to hit some standards. The manner in which the Common Core State Standards are written lends themselves to the kinds of experiences students might have in a full project-based experience as defined by say, the Buck Institute for Education.

The Buck Institute for Education devotes its efforts to promoting project-based learning. They identify "in-depth inquiry," "driving question," "need to know," "voice and choice," "revision and reflection" and "public audience" all surrounding "significant content" and "21st Century skills" as their key components to project-based learning. The Buck Institute for Education is a rich resource for any exploration of project-based learning including defining it (Buck Institute for Education, n.d.). It is clearly evident through their work and the works of authors affiliated with them, that the idea that project-based learning is the main vehicle by which content is delivered and standards. (Markham et al., 2003).

2.1.5.2 Collaboration in Project-based Learning

What differentiates project-based learning from more traditional forms of education is how students work in, through and around the content. This kind of activity separates students from a controlled, single-student focused learning to one that is group-focused, messy, dynamic and collaborative. Several authors write of the importance of collaboration and how it is central to the learning process in project-based learning (Barell, 2003; Bender, 2012; G. Solomon, 2003). John Barell (2003) wrote about this in terms of curious people in pursuit of learning and

prompted by their collaboration (Barell, 2003 p. 23) and Gwen Solomon (2003) writes of collaboration being at the core of all project-based activities whether they are in the classroom, in the lab or in the field. Often the way the students collaborate will be very focused and purposeful, sometimes identifying specific roles for each member of the group. Thom Markham (2011) writes about this aspect of collaboration as focused teams matched to what one would see in industry (Markham, 2011). William Bender (2012) writes, "as students become adept in PBL instructional experiences, they will also become seasoned team players who are used to planning activities as a team, specifying roles for various team members, working together to solve problems, and offering appropriate and helpful peer evaluations of each other's performance" (Bender, 2012 p. 52).

2.1.5.3 Teacher as Facilitator

But perhaps the best way to understand how the role of the student changes in project-based learning is to understand how the role of the teacher changes. In project-based learning, the teacher's role moves from content-deliverer to content-guide, from lecturer to facilitator. In project-based learning, traditional teacher roles can be challenged as students make choices on how to approach a problem, present findings or identify what the driving question or questions will be (Bender, 2012; Larmer, 2009; Manning, Manning, & Long, 1994). The degree to which a teacher is comfortable with the decision making switching from the teacher to the students will in some degree influence the quality of the collaboration in the project.

2.1.5.4 Skills in Project-based Learning

In a traditional classroom, the purpose is to deliver to the student the set content of a particular course. Project-based learning differs in that it seeks to address a central problem using whatever content or skills are needed to do so. In fact, project-based learning engages students in skills necessary in the modern workplace (Bender, 2012). Markham (2003) calls these "habits of mind" and include skills common in most literature about project-based learning – such as critical thinking, flexibility, ability to work in groups, think creatively, etc. (Bell, 2010; Boss, 2012; Larmer & Mergendoller, 2010; Solomon, 2003). The project goals and the standards identify the distinct association the project has to a course, but the skills listed above and in the literature transcend segmented course titles and provide an opportunity to cross disciplines through the project.

2.1.5.5 Assessment

The way that learning is assessed is yet another way to understand project-based learning. Much of the assessment that takes place in project-based learning experiences is authentically generated – a quality check on group progress, a assessment of content knowledge to gauge readiness to address a driving question, or a final presentation of findings much in line with what someone would do in the workplace. Because of this, students are assessed differently in the project-based learning classroom. Self-reflection, group reflection, process and project evaluation all play a role in the quality control process of the learning experience. Much of the literature about project-based learning addresses the need for assessing student learning through a discussion of rubrics (Barell, 2010; Bell, 2010; Boss, 2012; Callison, 2006; Larmer & Mergendoller, 2010). Rubrics capture the breath of content and standards as well as the process of getting at the content and standards. Rubrics can identify progress toward previously

identified goals and how well the group has worked together to meet the goals. Rubrics can be either holistic or analytic/descriptive. The holistic rubric provides a general descriptor of performance to derive a grade. The analytic rubric delineates levels of performance for each descriptor (Bender, 2012, p. 162). The use of rubrics is a way for the students to come to agreement on the goals of the project by how it will be assessed and can be used as a formative and summative assessment tool throughout the learning process (Markham et al., 2003).

Self-reflection through journaling is also another important form of assessment in project-based learning (Barell, 2010; Bender, 2012; G. Solomon, 2003). Like with the use of rubrics, self-reflection can be used for a wide range of evaluation and assessment purposes. Students can reflect after a task is complete or as a part of a quality check as the project is progressing. The reflection can be about the process or the product. It can be used to derive a grade or to determine the quality of the learning experience for the groups or the individuals in the groups (Bender, 2012). Students can use charts or rubrics or simply use a journal or discussion prompts.

2.2 LITERATURE CONCERNING PROJECT-BASED LEARNING EFFECTIVENESS

This study explores, in part, how teachers respond to challenges they face when implementing project-based learning. The selected literature reveals the degree to which, and under what applications, project-based learning has been effective in K-12 schools. The literature represents project-based learning as broad, systematic change to traditional teaching. It

serves as a framework for understanding how teachers might make project-based learning more or less effective by how they change their response to the challenges they face.

2.2.1 Effectiveness as Measured by Standardized Tests

Project-based learning has been shown to be as effective as traditional methods as measured by direct summative, achievement or standardized tests (Thomas, 2000). One of the most commonly cited studies in the literature (Bell, 2010; Bender, 2012; David, 2008) of this type is by Jo Boaler (Boaler, 1998a, 1998b, 1999). Her studies bear some extended discussion simply because they add clarity to the question of impact of project-based learning on student learning not only on standardized tests but also on long-term retention. The Boaler study describes a three-year examination of project-based learning and traditional approaches (Boaler, 1998a, 1998b; Thomas, 2000).

Boaler (1998a, 1998b) was interested in the transference of mathematics knowledge from classroom instruction and, then how that knowledge is used outside of the classroom (Boaler, 1998a). To study this, she conducted a three-year case study of two schools, one that used a traditional textbook approach to teach mathematics and another that used a more open project-based environment to learn mathematics. She followed two cohort groups of students (300 students in all) for three years starting at age 13 to age 16 during which she observed between 80 and 100 lessons as a "participant observer" as well as interviewer (Boaler, 1998b; Thomas, 2000). She also collected quantitative data from assessments she administered or analyzed data from various school, external and national assessments for these groups of students.

Boaler (1998b) analyzed the national assessments in mathematics as a part of the three-year study. After analyzing the testing, Boaler (1998b) found that students from the more

traditional school showed a difference in how they scored on procedural compared to conceptual questions with better performance on the former. In the project-based school, there was almost no difference in performance between these two kinds of questions (p. 136-137). Overall, students at the project-based school performed similarly to the traditional school on the procedural questions and much better on the conceptual questions (p. 135).

Ultimately, the Boaler (1998b) study suggested the students from the two schools developed different kinds of mathematical knowledge (Thomas, 2000). Students from the more didactic, traditionally taught school were able to apply specific mathematical skills shortly after taught and demonstrated knowledge of mathematical procedure. Students at the more open, project-based school were able to still sufficiently demonstrate knowledge procedure but also showed superior mathematical conceptual knowledge and were able to apply that knowledge beyond traditional classroom contexts.

Many of the skills inherent in project-based learning have a greater focus on students building knowledge through the process of tackling a problem rather than rote memorization after lecture. Standardized tests measure the latter rather than the former (Ravitz, 2009). For this reason, selected literature suggests that project-based learning is not the most effective means of addressing some student learning as measured by standardized tests especially when the tests are designed to assess skill obtained through rote memorization. The Boaler (1998) study showed the students performed on par with their traditionally taught peers on sections of the assessment designed to assess procedural math. Other studies show project-based learning does no better at preparing students to achieve on standardized tests than traditional methods of teaching and learning. In one such study, 44 6th graders were sampled – half in a project-based environment the other half in control group in a more traditional setting to explore the efficacy of

project-based learning in addressing student achievement in mathematics. The quasi-experimental study examined results on one northeastern state's assessment to determine if the students in the project-based contexts faired better than students in the control group. The study found that there was no statistically significant difference in the students' math performance (Quigley, 2010).

Nevertheless, the literature supports that students who engage in project-based learning do and quite a bit better than their peers in application of concepts (Boaler, 1999; Geier et al., 2008; Strobel & van Barneveld, 2009). A study that fits the criteria for this review and is a summative look at the effect of project-based learning on achievement comes from (Geier et al., 2008). The study examined the three-year (ending in the 2000-2001 school year) implementation of a project-based inquiry science curriculum developed in connection with the Center for Learning Technologies in Urban Schools (LeTUS). The LeTUS curriculum carried many of the same elements associated with project-based learning including an inquiry investigation, a driving question, embedded technology, student-created artifacts, discussion and feedback.

The study examined how well the study group of students did on the Michigan Educational Assessment Program (MEAP) tests compared to students who did not experience the curriculum. Thirty-seven teachers in 18 schools and approximately 5000 students participated in two 7th grade and one 8th grade LeTUS unit (Geier et al., 2008 p. 926-927). Of the two cohort groups studied, both performed better than their non-LeTUS taught counterparts on the MEAP tests in all science areas.

In another example, Thomas (2000) highlights the impact project-based learning has on student achievement on standardized tests in his discussion of Expeditionary Learning schools with respect to a summary report by the New American Schools Development Corporation

(Bodilly, Keltner, & Purnell, 1998). The report summarizes findings on ten schools in three cities over school years 1995 through 1997 and shows data that nine of the ten schools saw an increase in student achievement over these years.

More specifically, of the three elementary schools in Dubuque, Iowa that implemented the Expeditionary Learning model, all three showed increases in achievement on the Iowa Test of Basic Skills while the other schools in the district remained the same. The Expeditionary Learning schools in Boston demonstrated strong results on the Stanford 9 test – an inner city 8th grade class that scored second highest in the district and an elementary school that ranked 11th in mathematics and 17th in reading respectively out of 76 elementary schools in the district despite the very diverse population represented in the school. And in Portland, Maine, middle school students attending Expeditionary Learning schools saw increases in all areas tested on the Maine Educational Assessment (Thomas, 2000 p. 9-10).

These schools saw increases in achievement after implementation of the Expeditionary Learning model despite the fact that they often served traditionally low-performing students. Though Thomas (2000) points out that project-based learning was just one part of an entire systemic reform effort for these schools, it is likely that the curricular approach using project-based learning had some impact on student performance on standardized testing (Bodilly et al., 1998; Thomas, 2000).

Another example comes from (Summers & Dickinson, 2012) who conducted an longitudinal study to examine achievement toward college and career readiness as defined by the Common Core State Standards through social studies classes in two rural high schools in the same school district. Specifically, they wanted to examine if project-based learning promoted higher rates of promotion, higher social studies achievement on standardized assessment and

facilitated a greater realization of the College and Career Readiness standards and generally enhanced students' learning in social studies (p. 85). For the purposes of this discussion, the second question is of interest.

On the question of achievement, Summers and Dickinson (2012) looked at three years of standardized testing – 8th grade, 10th grade and an exit test, which generally fell at 11th grade comparing the project-based learning school to the traditionally taught school. As reported, "significantly higher percentage of PBI students scored at the pass and commended levels for all three applicable testing years than their counterparts at Trad HS" (p. 97). The researchers found promise in the use of project-based learning to help realize the College and Career Readiness Standards as well as a means to promote equity in diverse school systems (p. 99).

The selected literature on efficacy of project-based learning indicates that it promotes achievement on standardized tests, though traditional education can also lead to positive achievement. The determining factor seems to be the kinds of questions or the kind of task required on the assessment. If the test assessment requires procedure from rote, short-term memorization, then traditional methods works fine – though project-based learning fairs just as well. However, if the question requires more conceptual work or application, project-based learning preparation appears to be superior (Boaler, 1998b).

2.2.2 Project-based Learning and Long-term Knowledge Retention

Long-term knowledge retention is one of the most prominently mentioned traits common to both Problem-based and project-based learning that seems to be a benefit of both kinds of approaches. Boaler (1998b) found this to be true with the results of her "long-term learning tests" (p. 134) that showed students from the project-based learning schools remembered more after six

months than did students from the more traditional school and, again, it is one of the learning elements favored by Problem-based Learning as reported by Strobel and Van Barneveld, (2009).

Strobel and Van Barneveld (2009) found that in the knowledge assessment category, short-term retention results were mixed when compared to traditional learning methods, but long-term favored Problem-based Learning in retention of knowledge. They found similar results in the performance or skill-based assessment and mixed knowledge and skill categories. Short-term retention favored traditional methods and long-term retention of knowledge and skills favored Problem-based Learning (p. 53-54).

2.2.3 Project-based Learning and Student Motivation

Strobel and Van Barneveld (2009) reported greater student and staff satisfaction from Problem-based Learning methods (p. 51). This speaks to a common trait that comes up in the literature when researching the topic. Beyond this, the literature supports a connection between project-based learning and student motivation to learn (Blumenfeld et al., 1991; Bradford, 2005; Chang & Lee, 2010; Lam, Cheng, & Ma, 2009; Strobel & van Barneveld, 2009).

Project-based learning carries with it a different structure. Students are often out of seats, working in groups, with a variety of materials, at different stages of learning, with different standards and skills at different times. It is a decidedly different approach that the traditional classroom where one might imagine students sitting in rows, learning the same content, in the same way, at the same time. Leland and Kasten (2002) describe this traditional model as "an industrial model of education" designed to emphasize "explicit rules and regimented behavior (p. 6-7). In this model, students were seen as "products on the assembly line" where they received the "same curriculum and expected to achieve the same understanding" (p. 8).

The value of project-based learning is that it allows for student choice and voice, collaboration, a focus on authentic problems, the opportunity for feedback and revision and an emphasis on technology and open up the learning environment to different learning styles and interests – all of which can increase student motivation and satisfaction in the learning process. (Bender, 2012; Larmer & Mergendoller, 2010; Markham et al., 2003).

2.2.4 A Range of Findings on Effectiveness Via Problem-based Learning

Like Boaler (1998a, 1998b), a meta-synthesis and a meta-analysis study on Problem-based Learning addresses more than just one of the learning impact questions identified above and, because of this, is reviewed here (Strobel & van Barneveld, 2009; Walker & Leary, 2009).

Though there are distinct differences between project-based learning and problem-based learning, problem-based learning captures some elements of project-based learning to allow for an examination of studies that focus on it. At their foundation, both project and problem-based learning are more open, authentic, collaborative and focused on inquiry. Despite the distinction between the two, it is important to examine what selected literature reveals about problem-based learning as a means to explore efficacy related to common elements in project-based learning.

There have been several studies that have focused on problem-based learning that help elucidate how elements common to both problem-based learning and project-based learning impact student learning in K-12 education (Maxwell, Mergendoller, & Bellisimo, 2005; Mergendoller, Maxwell, & Bellisimo, 2006; Ravitz, 2009; Strobel & van Barneveld, 2009; Walker & Leary, 2009). Some of these have been meta-synthesis or meta-analysis of studies on problem-based learning (Belland, French, & Ertmer, 2009; Ravitz, 2009; Strobel & van Barneveld, 2009; Walker & Leary, 2009). Though these studies primarily focus on the education

of medical students, they are still relevant for this discussion because the studies make connections to K-12 education (Ravitz, 2009; Strobel & van Barneveld, 2009; Walker & Leary, 2009). The matrix below adds clarity and detail regarding the two of the studies most relevant to this review.

Table 3 - Summary of Effectiveness Research

Authors	Type of Research	Methods and details	Outcomes and findings
Strobel & van Barneveld (2009)	Meta-synthesis of PBL studies to look a) if differing definitions and measurement of learning contributed to differences in conclusions of effectiveness and b) general statements about effectiveness of PBL	Meta-synthesis of meta-analyses of PBL studies Studies conducted since 1992 Reproducible methods; Reported PBL compared to traditional methods Total of eight studies synthesized	Non-performance, non-skill-oriented,non-knowledged based assessment (student and staff satisfaction) – favored PBL Knowledge assessment (multiple choice, true/false) – mixed results, favored traditional Performance or skill-based assessment (simulations, elaborate assessments) – favored PBL Mixed knowledge and skill assessment (oral exam, unsupervised practice) – favored PBL
Walker & Leary (2009)	Meta-analysis to investigate differences in PBL outcomes and to characterize PBL implementations and investigate features that may act as moderators in student achievement.	Meta-Analysis of from PBL studies Quantitative outcomes of student learning or reasoning processes Data reported showing comparison between PBL and control (lecture) Data from 201 outcomes over 82 studies were	Discipline: Majority of outcomes in medical education; most promising in teacher education Assessment Level: principle level in favor of PBL; application – modest results; concept level – identical to lecture;

Table 3 Continued

		reported	PBL students are more hypothesis driven Problem type: diagnosis solution had the largest single effect size in the studies PBL Method: PBL does better with the closed loop approach – caution is suggested due to lack of data Conclusions: Analysis shows that PBL students did as well as or better than lecture students; tended to do better when subject was outside of medical education

Table by M. Harris

As the matrix above shows, the meta-analysis and meta-synthesis above demonstrate through different analyses that students who engage in problem-based learning far better than students who are taught more traditionally. Strobel & van Barneveld (2009) demonstrated this by reviewing problem-based learning studies and analyzing them according to four learning assessment descriptors: Non-performance, non-skill-oriented, non-knowledge based assessment, knowledge assessment, performance or skill-based assessment, mixed knowledge and skill assessment – three of which favored problem-based learning all except knowledge assessment which showed mixed results.

The Walker & Leary (2009) study examined 201 problem-based learning outcomes from 82 studies in four different categories: discipline (as in the career field), assessment level,

problem type, and PBL method the general conclusion of which showed positive impact of PBL on students.

All of these meta-analyses and meta-syntheses provide a general overview of the effectiveness of problem-based learning specifically and via proxy, project-based learning since they are so related. Like the Boaler (1998a, 1998b) study, they provide a foundation for this review because they address a more than one impact question.

2.3 THE CONNECTION BETWEEN PROJECT-BASED LEARNING AND 21ST CENTURY SKILLS

The term "21st Century skills" is used in the literature, a part of everyday educational lexicon and, because of this, has become a bit cliché (Gut, 2011; OECD, 2012; *Personalizing Learning in the 21st Century*, 2010; Risinger, 2008). The term means different things to different people. For many, it simply means students using technology. To understand the connection between project-based learning and 21st Century skills, the definition has to be much broader. Understanding the specific manner in which the Partnership for 21st Century Skills defines 21st Century skills provides the foundation upon which to discuss how project-based learning is connected to it.

2.3.1 Defining 21st Century Skills

The Partnership for 21st Century Skills is a leader in defining and promoting the use of 21st Century skills in schools (Partnership for 21st Century Skills, n.d.). Their mission is to serve as a catalyst for 21st Century skills seeking to form private and public partnerships to make 21st Century skills the central educational focus of our country's schools (Parntership for 21st Century Skills, n.d.). K-12 schools look to them as a leading and current authority in defining 21st Century skills.

In order to fulfill their mission, the Partnership for 21st Century Skills had to define 21st Century skills and they did so by creating a framework that is really a holistic set of learning outcomes – skills and knowledge – that students need in order to be successful citizens in the 21st Century. The framework can be accessed on the Partnership for 21st Century Skills website (p21.org) or in documents they have available (Partnership for 21st Century Skills, n.d., 2011).

Within the framework, there are four main learning 21st Century learning outcomes:

1. Core Subjects and 21st Century Themes
2. Learning and Innovation Skills
3. Information, Media and Technology Skills
4. Life and Career Skills

The Core Subjects include many of the traditionally core subjects historically associated with school – subjects like English, World Languages, Arts, Mathematics, Economics, Science, Geography, History and Government and Civics. But, interestingly, this first part of the framework also includes 21st Century Themes that are cross-curricular in nature and include Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Civic, Health and Environmental Literacy. The purpose of these themes is to help students go beyond the core subjects and make connections at a higher level.

The Learning and Innovation Skills section of the framework include the 4C's – Creativity and innovation, Critical thinking and problem solving, Communication, and Collaboration. Because of how often these skills are mentioned in the literature, they are the most easily recognizable as those associated with the skills educators and others say students need to be successful in the 21st Century (Gut, 2011; Rivero, 2010; Saavedra & Opfer, 2012; Salpeter, 2003; Schleicher, 2011).

Information, Media and Technology Skills is another area that people most associate with 21st Century skills. Interestingly, however, the Partnership for 21st Century Skills framework mentions the ability of students to collaborate and think critically in the context of a media, information and change-rich environment (Partnership for 21st Century Skills, 2011).

The final skill area, Life and Career Skills, is not so obvious to 21st Century skills but the framework includes them as essential for success. These skills deal more with a student's ability to navigate social situations, the ability to work with others, show initiative and leadership, be productive, responsible and self-directed.

2.3.2 Alignment of Skills

Students who experience project-based learning, are involved in problem-solving, critical-thinking and the ability to engage in inquiry (Barell, 2010; Boss, 2012). Project-based learning prepares students to be able to collaborate, negotiate, plan and organize (Bell, 2010). The same skills that are needed in the 21st Century workplace are the same skills needed for students to be successful in a project-based learning experience at school (Markham, 2011). Project-based learning offers students experiences that cannot be taught out of a textbook and, as Thom Markham (2011) put it, "refocuses education on the student, not the curriculum-a shift

mandated by the global world, which rewards intangible assets such as drive, passion, creativity, empathy and resiliency" (p. 39).

One recent study by Ravitz, Hixson, English and Mergendoller (2012), looked at teachers who have had professional development in project-based learning and if these teachers teach and access 21st Century skills to a greater degree than teachers who have had no training in project-based learning (Ravitz, Hixson, English, & Mergendoller, 2012). They defined 21st Century skills according to eight traits: critical thinking skills, collaboration skills, communication skills, creativity and innovation skills, self-direction skills, global connections, local connections and using technology as a tool for learning and used these to survey 60 teachers, culled from over 600 who had used project-based learning and had been trained in it. They also identified a comparison group of teachers who had not used project-based learning or had limited professional development in project-based learning (p. 3-4).

Overall, the study showed that teachers who used project-based learning and had received professional development in it reported more teaching and assessment of 21st Century skills compared to teachers who did not use project-based learning.

The connections between the two are clear. The table below highlights the connection between common traits associated with project-based learning and 21st Century skills as they are defined by the Partnership for 21st Century Skills.

Table 4 - Project-based Learning Traits and 21st Century Skills

Project-based Learning Traits	**21st Century Skills**
Central to the curriculum, not peripheral (Markham, et al, 2003)	Core Subjects and 21st Century Themes
Driving question and inquiry (Barell, 2003; Bender, 2012) Creativity and innovation (Bender, 2012)	Learning and Innovation Skills • Creativity and Innovation • Critical thinking and Problem

Table 4 Continued

Working with others to solve problems	solving • Communication and Collaboration
PBL creates a context for authentic use of technology (Larmer & Mergendoller, 2010)	Information Media and Technology Skills
Creates positive communication and relationships among diverse learners (Markham et al., 2003) Encourages intrinsic motivation (self-starting and self-managing) (Markham, 2011)	Life and Career Skills

Source: Created by the author

2.3.3 The Historical Connection of Project-based Learning and 21st Century Skills

The parallels between both 21st Century skills and project-based learning come from a direct progression of historical events in educational policy and American history.

On October 4, 1957 a small metal object passed over the United States four times at an orbit of 588 miles causing a national panic and immediate reaction of concern that the Soviets were outperforming Americans in technology and science posing grave risk to our national security. It was not long after this that this national panic became a call for change in our educational system formalized in the National Defense Education Act of 1958, which enacted unprecedented funding for education – particularly for math and science (Telzrow & Welch, 2007).

Key components to this act was a 1 billion dollar expenditure over four years in loans, scholarships and fellowships to increase pursuit of undergraduate and graduate degrees particularly in math and science. Title III of the act provided matching funds for K-12 schools to invest in new science facilities and equipment and strengthen science, mathematics and foreign language instruction, in general. Other parts of the act addressed the preparation of teachers in

mathematics and science and counseling training to help identify students with outstanding abilities (Ebert Flattau et al., 2006).

The act and its instigator, Sputnik's apogee orbit over the United States, are often cited in educational literature as a 20th Century turning point in education (Flynn, 1995b; Friel, 2005; Jr, 2010; Kim, 2011; Semeniuk, 2007). Certainly, the funding alone did something to our educational system, but it seemed more than just that.

The nervous energy, or perhaps downright fear, behind the efforts to increase mathematics and science education and promote the advancement of our best and brightest, first changed school curricula and approaches and then, eventually, industry when newly trained mathematicians and scientists entered the workforce and began to influence industry. The crowning American achievement of all this science and mathematics focused effort was probably on July 16, 1969 when Apollo 11 launched for the moon and four days later on July 20, 1969 when Neil Armstrong walked on it (Mansfield, n.d.).

In a sense, this period of math and science educational fervor was an early STEM (science, technology, engineering and mathematics) initiative launched from an historical event – Sputnik – that led to legislative action – the National Defense Education Act – that increased the educational focus on mathematics and science in schools – that led to a national win in space.

This early focus on mathematics and science, culminating in an achievement in technology is, perhaps, the 20th Century version of what educators and politicians refer to as 21st Century skills – the kinds of innovation and college and career readiness skills they say they would like students to have. Because of our nation's history as described above, it is easy enough to see why educators and others might package skills and learning associated with innovation and technology under one term.

2.3.4 A Nation at Risk

By the time the 1970s were over, the country and its educational system were not the same. In fact, it became widely understood that many of the gains made in the 1950s and 1960s had been lost in the 1970s. The damning report that made such claims was *A Nation at Risk: The Imperative for Educational Reform* (US Department of Education, 1983). The report, generated by the National Commission on Excellence in Education at the bequest of T.H. Bell, then U.S. Secretary of Education examined the quality of education in the United States. They were also charged with looking at U.S. schools and colleges compared to those in other developed countries; examine the relationship between college admission requirements and high school achievement; look at the most successful programs in schools; examine the biggest social and educational changes that have effected achievement; and to identify challenges that the educational system has to be meet in the coming years ("A Nation at Risk : The Imperative for Educational Reform," 1983 p. 7).

The commission organized their concerns into four areas: content, expectations, time and teaching. The content section expressed concern over the directionless manner in which curricula had been applied in American schools. They called it a "curricular smorgasbord" causing students to opt out of taking more advanced courses and in effect watering down the curricular efforts of the schools. Even then the commission saw that schools perhaps "emphasize such rudiments as reading and computation at the expense of other essential skills such as comprehension, analysis, solving problems, and drawing conclusions" (p. 12). They saw that students needed basic skills but much more than this as well in order to "respond to the challenges of a rapidly changing world" (p. 14) and they saw that the patchwork curriculum that was offer by schools at the time was not going to get student there.

Though the other concern areas are important, the content section is most important to this review. In it rests the reason why political forces and education later moved toward a system that established state-developed academic standards and from these state standards, develop national standards that asked for different kinds of skills to prepare students for modern society. This progression of standards helps us understand the context of the current resurgence of 21st Century skills and by proxy of project-based learning.

2.3.5 The Standards Movement

The *A Nation at Risk* report is widely held to be the catalyst to the start of the standards movement (Lefkowits & Miller, 2006). After this report several subject-specific efforts started to develop content and skill standards. The National Council of Teachers of Mathematics, for instance, was one such institution that developed mathematic standards during the 1980s. The Governors' Education Summit of 1989 and Goals 2000 legislation were other efforts to promote educational standards during the late 1980s and 1990s (Barton, 2001).

Though the Elementary and Secondary Education Act was enacted in 1965 and originally authorized just through 1970, it has gone through several reauthorizations. The 1994 reauthorization was the legislation that formalized the standards movement into a state-led national requirement of schools. The reauthorization required states to establish content and performance based standards and to match testing to these standards (Barton, 2001).

President George Bush's No Child Left Behind reauthorization of the act in 2001 fundamentally changed the focus to one of unprecedented accountability in education ("Elementary and Secondary Education Act of 1965," 2009). It also brought with it unprecedented criticism, namely that the law instituted mandates with no funding to support

them (Nowicki, 2006) and that the law required that schools achieve unreasonable targets on state tests (Lewis, 2002b).

One of the biggest criticisms and the one most pertinent to this review is that No Child Left Behind carried with it punitive measures for schools if they did not meet the targets for students in various subgroups and, because of this, caused schools to narrow the curriculum and instructional approaches in the schools (Gentry, 2006; Lewis, 2002a). The phrase "teach to the test" became commonplace. Even if schools did not exactly "teach to the test," there was still concern that curriculum and instruction narrowly focused on rote math and reading skills, de-emphasizing other content areas and other kinds of learning. This happened even more so in the poorest schools since the poorest schools often had the greatest challenges and, hence, were in greatest danger of the law's sanctions (F. Johnson, 2011).

2.3.6 Moving Beyond Standards

In 2008, the U.S. Department of Education published a response to the original *A Nation at Risk* report titled, *A Nation Accountable: 25 Years After A Nation At Risk* in which the authors summarized the progress made in education since the 1983 report was published and following the various reauthorizations of the Elementary and Secondary Education Act including the standards movement-focused 1994 reauthorization and No Child Left Behind of 2001. The report acknowledges the strides made to deeply examine student achievement because of the accountability mandates of No Child Left Behind, but it also sees the lack of progress in our schools since 1983 (US Department of Education, 2008).

In fact, language in the report points to the need for other kinds of skills not garnered by the changes enacted by No Child Left Behind. The report claims an even greater risk than one

present in 1983 – one that is based upon the "demands of a global economy" (p. 6) – one that the report claims our students are not prepared to meet (p. 6). The report finds that American outcomes on international comparisons have not improved and, generally, that other countries are passing us by (p. 9). The report sees a need for schools to teach students to respond to the rapid changes to technology and how this has influenced how students and teachers learn and interact (p.14).

2.3.7 The Common Core State Standards

The need for something different spawned the next phase of the standards movement – the Common Core State Standards, which not only asked for a greater depth in content but also guided students to be "college and career ready." The Common Core State Standard address the narrowing of the curriculum concerns of No Child Left Behind (Lewis, 2002a) and rigorous content and application of skills (Common Core State Standards Initiative, 2010). More importantly, the Common Core State Standards are designed to help schools instruct students on content and skills that prepare them for success in college after high school and for careers after that. Specifically, the Common Core State Standards are:

- Aligned with college and work expectations;
- Include rigorous content *and* application of knowledge through high-order skills;
- Build upon strengths and lessons of current state standards;
- Informed by top-performing countries, so that all students are prepared to succeed in our global economy and society; and,
- Evidence and/or research-based (Common Core State Standards Initiative, 2010).

Additionally, the Common Core State Standards entire focus is to prepare students to compete globally – success measured against international benchmarks (National Governors Association and The Council of Chief State School Officers and Achieve Inc., 2008).

Several organizations recognized the value of the Common Core State Standards in teaching 21st Century skills. The US Department of Education, the College Board, and the State High Education Executive Officers all saw the Common Core State Standards as a step forward in helping schools prepare students to compete globally and use what were generally referred to as 21st Century skills to do so (College Board, n.d.-a; State Higher Education Executive Officers, 2009; US Department of Education, 2009). The State Higher Education Executive Officers, for instance, praised the Common Core State Standards for being "internationally benchmarked" and for taking "into consideration the need for all students to learn more in order to thrive in the 21st century" (State Higher Education Executive Officers, 2009).

Both the Common Core State Standards and the Partnership for 21st Century Skills framework are responses to the need to prepare students differently so that they are competitive globally. Both are learning outcomes and skills that describe what students should know and be able to do when they leave high school. The College and Career Readiness Standards and Partnership for 21st Century Skills Framework have distinct connections. The chart below demonstrates these connections.

Table 5 - Common Core State Standards Connection to 21st Century Skills Framework

Common Core State Standards	**Parallels to the Partnership for 21st Century Skills Framework**
Demonstrate independence	Life and Career Skills
Build strong content knowledge	Core Subjects and 21st Century Themes
Respond to the varying demands of audience, task, purpose, and discipline	Learning and Innovation Skills (Communication and Collaboration)
Comprehend as well as critique	Learning and Innovation Skills (Critical thinking and Problem-solving)
Value evidence	Information, Media and Technology Skills

Table 5 Continued

	(Information Literacy)
Use technology and digital media strategically and capably	Information, Media and Technology Skills
Come to understand other perspectives and cultures	Life and Career Skills (Social and Cross-cultural skills)

Source: Created by the author

The connections are evident because both initiatives were started to address the same concerns that started with the publication of the *A Nation at Risk* report in 1983 – concerns that were not fully addressed through the increased accountability measures instituted through No Child Left Behind of 2001. Despite the fact that both efforts seek to prepare schools and students to compete globally in an ever-changing modern world, neither effort proposes a specific instructional approach to get there.

Both of these sets of outcomes and skills, however, set context for schools to develop instructional approaches that would realize these outcomes and skills. Project-based learning came from the historical events that lead to No Child Left Behind of 2001 and the standards movement as well as the focus on 21st Century skills (Bell, 2010; Flynn, 1995b; F. Johnson, 2011; Lewis, 2002b; Saavedra & Opfer, 2012; US Department of Education, 2008).

2.3.8 How the Literature Informed the Research

This literature review addressed the discourse on the varying definition of project-based learning including its key elements and skills. By doing so, the research conducted in the study is on better contextual footing establishing that there is no one true definition of project-based learning and no one true approach to project-based learning. The results of the study can expect

no pure adherence to some project-based learning universal curriculum; there is none. There is, however, as the literature shows, trends in common definition that give form to what is known as project-based learning (Bender, 2012; Hammerman, 2006; Larmer & Mergendoller, 2010; Markham et al., 2003). This review also informed the research by revealing the theoretical foundations of project-based learning through the foundational work of some of education's most recognized theorists and researchers (Dewey, 1938; Piaget, 1973; Vygotskiĭ & Cole, 1978). Similarly, the literature provided the historical perspective – the connection to Sputnik, education policy and law, the rise of standards, 21st Century skills and international competiveness. Efficacy of project-based learning was reviewed, as was the discourse on implementation research. The former is vital to understand the impact project-based learning has on student learning and the later in terms how change affects teachers when any new innovation, like project-based learning is introduced. All the literature creates a clearer understanding of the context in which to understand the results of the study, how to interpret them and how the results will be most useful to educators.

3.0 STUDY DESIGN

3.1 INTRODUCTION

This study examines teachers' perceptions of the challenges they face when implementing project-based learning, how they address those challenges and their perception of the role 21st Century skills play in implementing project-based learning. Project-based learning often challenges teachers' previous teaching methods. What they think about these challenges and how they respond to them may give insight into future implementations of project-based learning. Likewise, 21st Century skills are a focus for a modern education (Salpeter, 2003), and project-based learning is said to be an even better deliverer of these skills (Alsop-Cotton, 2009a; Bell, 2010; Gunter, 2007). Do early implementers of project-based learning perceive them to be so? The perceptions teachers have concerning the challenges they face, their responses and the role of 21st Century skills form the context for this study's design. Specifically, the study seeks to answer the following research questions:

1. What challenges do teachers perceive they face when implementing project-based learning?
2. What ways do teachers respond to these challenges?
3. What are teachers' perceptions about project-based learning as a way to teach 21st Century skills?

An analysis of the results of a study focus on these questions should help to determine what challenges teachers most and least when implementing project-based learning as well as

how they respond to these challenges. The results should also provide insight into how teachers perceive the role of 21st Century skills in project-based learning implementations. An analysis of the results of all of the questions will inform future implementations and professional development project-based learning.

3.2 RESEARCH METHODS AND PROCEDURES

This study focuses on perception or as Fowler (1995) calls them, "subjective states" and though, as he tells us there are no right or wrong answers, "this does not mean there are not standards for questions designed to measure subjective states" (p. 46). The study, then, is designed to capture data on teachers' "subjective states" as they relate to their perceptions of the implementation of project-based learning and the role of 21st Century skills. To this end, the study employs a questionnaire designed to gather data on the perceptions of teachers related to challenges of implementing project-based learning. It is a descriptive study in that it seeks to produce information about what is happening in relation to the target of the research (Mertens, 2010) – in this case, the perceptions teachers have when they change instructional approaches. The design of this questionnaire is guided by selected literature such as Fowler (1995) and Converse & Presser (1986) to best describe the phenomenon of the challenges teachers face when implementing project-based learning, how they address these and the role of 21st Century skills.

The development of questions for the questionnaire was an important aspect of the study. The questionnaire included both closed and open questions in order to describe the phenomenon to the greatest degree possible. In this case, the research sought to gather specific data on how

many project-based experiences teachers had against a set list as well as openly explain these experiences in free written text. Though Converse & Presser (1986) support more closed ended items in survey, the literature also supports backing closed items with open when the answer is too difficult or complicated to reduce to a few words, or more importantly, when valuable data would be missed. As Fowler (1995) states, "When knowledge is measured in a true/false or multiple-choice format, some correct answers can occur by chance and not reflect knowledge of the subject. Open-ended answers to questions usually are a better way to find out what people know (p. 178).

The study sought to gather data from participants who have any kind of experiences related to project-based learning and that allow for insight into the phenomenon in question and, by answering the questionnaire, could shed light on the problem. The study asked for volunteers from the entire teaching staff to share their perceptions of the challenges of implementing project-based learning experiences like these. However, not all teachers have the same degree of experience with project-based learning. For instance, teachers assigned to teams, that is, teachers who teach core content areas and special education and reading teachers, have more direct experience with project-based learning than arts teachers or foreign language teachers. Though all staff were offered the chance to participate, some chose not to participate because they have not had the opportunity to take part in project-based learning experiences. Since all teachers may have had the opportunity to take part in project-based learning experiences, it was important to initially offer the opportunity to participate to the entire staff.

The study questionnaire was administered online via the Qualtrics Survey System ("Introduction to Survey Research | Qualtrics," n.d.), which allows for a web-based development, distribution and analysis of the questionnaire and data. Though required by the university,

literature supports the use of web-based administrations of questionnaires (Cook, Heath, & Thompson, 2000; Mertens, 2010). Cook, Heath & Thompson (2000) found higher level of response rate with internet-based surveys given three other factors: follow up contact with non-respondents, personalized contact and contacting participants prior to conducting the survey. In this study, participants had prior contact with the researcher as well as follow up contact.

Follow up occurred through email that included a link to the questionnaire and a review of the purpose of the study. The follow up allowed for any participants who did not respond the initial opportunity to have another chance to do so. The follow up also allowed the researcher the opportunity to reaffirm the rationale and goals of the study.

The specific procedures were guided by the literature and the rules governing proper steps for conducting studies in educational settings (Babbie, 2013; Hatch, 2002; Mertens, 2010). Specifically, the researcher secured written permission from the school district after explaining the purpose and format of the study and the potential benefits of the study. Secondly, the study obtained Institutional Review Board approval adhering to all requirements to obtain that approval. Third, the study was introduced to the principal of the school followed by the participants in the manner in which the principal felt it best to do so. After introducing the study, the researcher electronically followed up with the participants and non-participants to promote further completion of the questionnaire. Once the response period was completed, data was analyzed as described in the Methods section of this work and the Hatch (2002) typology system for open data. The one-sentence generalizations, as per the typological system, was compared to the quantified data in the Qualtrics system and analyzed and summarized. The summarization of the results were discussed in light of the research questions and in relation to the larger context of K-12 and secondary education.

3.3 APPROVAL TO CONDUCT THE STUDY IN AN EDUCATIONAL SETTING

As part of the Institutional Review Board process, the research protocol for the study included a consent process to conduct the study in the educational setting. This included verbal and written permission from the school district and school administration (Appendix B) and disclosure of the following consent language. Participants were notified that by participating in the study that:

- There is no payment for participating
- There are no foreseeable risks associated with participating in the study
- The questionnaire is entirely anonymous
- The data will be secured at all times
- Your participation is voluntary and you can choose to withdraw your participation at any time

The selected literature supports incentives to increase participant response rate (Cook et al., 2000; Fowler, 1995; Hatch, 2002), however, in the educational setting, incentives are not a common response for survey completion in this setting.

3.4 SUPPORT OF THE RESEARCH THROUGH A PILOT STUDY

Selected literature on questionnaires recommends field pretesting (Converse & Presser, 1986; Fowler, 1995; Mertens, 2010). In addition, the pilot should mimic the sample population, allow for comments on the questions asked, make the participants aware of the fact that the survey is a field test, and follow the same procedures used in the main study (Mertens, 2010). In April 2014 the study included a pilot to gather sample data relative to the larger study and to gather data on the questionnaire itself.

Participants were selected from a similar population and context. In this case, the five teachers who participated in the pilot were chosen for two reasons: 1) they had some limited experience with project-based learning and 2) they volunteered to take part in the pilot. The pilot was introduced to the participants in person, which included disclosure that the questionnaire was used as a field test for the survey questions. After the pilot was introduced, the questionnaire was administered through a web link by email. Of the five who were introduced to the pilot, all five participated.

The pilot test was used to adjust both the structure of the questionnaire, the task of completing it and the question wording. As Converse and Presser (1986) put it, pretest can test for, "variation, meaning, task difficulty, respondent interest and attention…'flow' and naturalness of the sections, the order of the questions, skip patterns, timing, respondent interest and attention, overall, respondent well-being" (p. 54-55). Of these, "meaning," "task difficulty," "the order of the questions," and "timing" were carefully considered in the pilot. Questions in the pilot specifically asked for feedback on meaning of questions, difficulty in answering questions, which questions were most difficult, length of time to take the questionnaire.

3.4.1 Pilot Analysis and Results

The pilot included mixed data from closed and open questionnaire items. Closed items were quantified through the Qualtrics Survey System and analyzed by frequency. Open items were organized by theme and summarized. The pilot used the research questions as central themes to guide the organization of the open data. The themes used were "Barriers to implementing PBL" "Responses to PBL" and "PBL and 21st Century Skills". Both kinds of data were compared for analysis and interpretation.

The results indicated that teachers perceived time to implement project-based learning and designing project-based learning experiences as most challenging when implementing project-based learning. When responding to these challenges, teachers indicated no clear answer to the "time to implement" challenge though there was some indication of making use of available time to address this challenge. To address the "design" challenge, there were indications of making use of available resources and collaboration. In the pilot, the 21st Century skills teachers perceived PBL did a better job teaching to students were initiative and self-direction, global awareness, critical thinking and problem solving, environmental literacy, and leadership and responsibility.

3.5 RESEARCH POPULATION

Participants in the study were middle school teachers from a school comprised of grades 6-8 with an enrollment of about 1038 students, 105 teachers, 3 guidance counselors and 2 assistant principals and 1 principal. The students are organized into academic teams that include a teacher from each content area – math, science, social studies, language arts and reading. There is also a special education teacher assigned to each team. The Arts and technology and other content area teachers are also represented in the school but not assigned to teams.

As indicated in the data, most teachers in the school are in the first years of implementing project-based learning, meaning that they have had fewer than three formal experiences implementing project-based learning experiences as defined in the study. It was expected that the teachers assigned to the teams had the most direct experience with the grade-level project-based experiences mentioned in the introduction of this section. However, teachers who are not

assigned to teams, arts or foreign language teachers, for instance, were found to also have experiences with project-based learning that was relevant to the study.

3.6 RESEARCH CONTEXT

Hatch (2002) ties decisions about context to decisions about participants. In this study, the two were closely connected. The participants in the study were from a suburban school district outside Pittsburgh, Pennsylvania who had some experience implementing project-based learning. Because of this, the context was uniquely timed to capture the perceptions of teachers in the early stages of implementing project-based learning.

Over the past three years, the teachers had some experience with project-based learning design. Specifically, each grades' teachers designed a grade-level project-based learning, authentic experience that focused on one or more STEMM (science, technology, engineering, mathematics, medicine) fields. The sixth grade experience simulated a viral outbreak. Students were presented with symptoms of a virus of which they had to determine the type and origination. The students chose real-life roles and worked in teams to address the situation. The teachers worked as facilitators, guiding the students' work and bringing in outside experts – epidemiologists, for instance, to help the students understand viruses and help them solve the problem. Students found the need to use technology to organize notes, develop charts and develop presentations at the end of the simulation.

The seventh grade experience focused on an engineering challenge. Students were organized into teams to design an amusement park – specifically rollercoasters. Students worked in real team roles like architect, engineer, public relations, and business manager to run the

finances. The students were responsible for maintaining accurate records and expenses throughout the experience as they first designed the roller coaster using software on a tablet where they could calculate forces and other design physics before building a real model. Like the sixth grade experience, the seventh grade experience included several project-based learning elements including a driving question, student choice, reflection and opportunities for revision and significant content.

The same can be said for the 8th grade project-based learning STEMM experience, which simulated a coronal mass ejection or solar flare that wipes out the global power grid leaving up to the students to find ways to keep society moving without power. To do so, students chose committees including government, sanitation, ethics, transportation, health, morale, and even the "Freedom Writers" who wrote everything the government committee wanted to keep classified. Students invented, debated, compromised, wrote, created and heard from real local safety officials before presenting about the experience. These grade-level experiences will be an important context for collecting perception data from the teachers, though other team-based and individual classroom-based data will also be relevant to the study.

3.7 FACTORS THAT MAY INFLUENCE THE STUDY

The number of teachers receiving the questionnaire may have influenced the study. Likewise, the fact that these teachers came from the same school may have limited the scope of the perceptions to that one school and relevant conditions that are attendant to it. What is unique, however, is that this school was in the first years of implementing project-based learning and made it uniquely primed for a study of this design. It was also supportive of the study to

consider single case research. In single case research, *Social Validation* can be used to serve as criteria of quality based upon the social significance in the context of a shared set of goals. Socially, the subject of the study would have had to have social validity – or deemed useful, applicable, meaningful - by those implementing (Daunic, Stichter, Conroy, & Haydon, 2008; Mertens, 2010).

Another possible limitation of the study was that the researcher is the former principal of the school in which the research is conducted. The researcher's former familiarity with the staff may have limited the study by altering the response data compared to conducting the study at a school where they do not know the researcher. That said, not knowing a staff in a school in which the researcher is conducting a study would have also altered the data. What is important is that the study is designed to work through the building principal and the questionnaire is delivered through hypertext link, both measures that distanced the researcher's influence on the participants and the data collected from them. Additionally Hatch (2002) supports a establishing a relationship with participants in order to conduct a study. In this study, the past relationship, now more distant, may have benefited the response rate rather than negatively influence the data, yet the limitation must be acknowledged.

The questionnaire itself may have served as a limitation if the wording of the items produced a different result than what was intended. Poor question design is just as much of a problem with surveys as is the ability to design surveys that produce the data meeting the original objectives of the study (Fowler, 1995). Particularly in a study that gathered data about perception, there was the potential danger of what Converse and Presser (1986) call "'acquiescence response set' – the tendency of respondents to agree irrespective of item content"

when faced with "agree-disagree" survey questions (p 38). But this is just one example of a question-type generating different results than intended.

Though precautions were taken to avoid confusion with wording or question construction, some confusion from the questions is inevitable or as Fowler (1995) states, "one standard for a good question is that all the people answering it could understand it in a consistent way and in a way that is consistent with what the researcher expected it to mean" (p. 2).

Aware of this limitation, the study included a process for careful attention to questionnaire construction in line with a process that, as Converse & Presser (1985) put it, "requires special measures to cast questions that are clear and straightforward in four important respects: simple language, common concepts, manageable tasks and widespread information" (p. 10).

Another potential factor that influenced the study may also be founded in how "challenges" are defined. For the sake of this study, "challenges" are defined as barriers – a negative connotation. However, it is possible that participants may have defined "challenges" as a positive – as something to be accomplished, or a stimulating situation, for instance. The manner in which respondents defined "challenge" potentially could alter the way participants responded to the question of what challenged them. For this study, the open-ended question for this item may have helped alleviate the concern over varying definitions by allowing participants to respond openly and address the answer to the question using the definition they had in mind. The analysis of the results of the open-ended through the typology method would capture the "challenge" definition under which the participants answered the question and allow the researcher to take into consideration the varying definition when interpreting the results.

Early on in my career as an educator, the researcher had an interest in connected content and cooperative learning. Sometime after this, the researcher became increasingly interested in technology and what became termed as "21st Century skills." Project-based learning soon encompassed an approached the packaged both these interests. Though this study is an inductive exploration of project-based learning, the researcher must acknowledge interest in the subject. The bias the researcher carries could have influenced the study survey questions, for instance or attended to the data analysis. The literature, however, helped with this concern and provided insight into how to avoid bias in survey questions (Babbie, 2013).

3.8 DATA ANALYSIS METHODS

The Qualtrics Survey System has the ability to tally all closed questionnaire items numerically. The system presented the minimum and maximum value, the mean, variance, standard deviation and the total responses of the closed items. Select data were graphically presented in charts for analysis and interpretation. The open-ended items were organized by theme then compared to the numerically grouped items for analysis and interpretation. More specifically, the data analysis method of the study followed the Typological Analysis method found in Hatch (2002).

After collecting the data, the researcher organized the data into predetermined typologies. For this study, the typologies were 1) The Rating of project-based learning Challenges, 2) The Responses to the Challenges, 3) Project-based learning and 21st Century Skills. Though these typologies served as initial guiding prompts for analyzing the data, once the analysis began it became clear that more specific themes emerged from the open-ended responses. Following

Hatch (2002), "once an initial set of typologies has been identified, I recommend that the data be read through completely with on typology in mind" (p. 154). This process was repeated for each typology, then, following Hatch's method, identifying the patterns and relationships that support generalizations about the data (p. 153). The typology analysis led to more specific themes to use in identifying patterns and relationships.

Research Question #1: What challenges do teachers perceive they face when implementing project-based learning?

To examine data related to research question #1, which relate to the challenges teachers face when implementing project-based learning, the study collected data based upon a fixed list of challenges. In addition, teachers were asked to list additional challenges in an open ended item. The closed rating data was analyzed using the Qualtrics Survey System to identify frequency counts of those challenges teachers found most and least challenging. This data was compared to the closed item data for further analysis identifying patterns and relationships.

Research Question #2: What ways do teachers respond to these challenges?

Research question #2 asks teachers to respond to their responses in question #1. To do so, they wrote in text boxes under the challenge headings listed under the items for question #1 and described how they would respond to these challenges. This type of data was individual to the teacher, reflective of the individual experiences of that teacher and too complex to be captured in a closed item or, as Fowler (1995) writes, "when the reasoning behind a conclusion, a behavior, or a preference is of interest, the best way to learn about it is to hear the respondent's own words" (p. 178). For this data, the respondents' own words served as the best source of data gathered through an open written item. Once gathered, the data was organized into the pre-identified typologies, more specific themes and organized into patterns to identify the important

relationships associated with the ways teachers responded to challenges.

Research Question #3: What are teachers' perceptions about project-based learning as a way to teach 21st Century skills?

To analyze research question #3, the study again asked teachers to respond to a fixed list of 21st Century skills and indicate degrees of agreement. This question asked teachers to think about an extensive list of skills and content and compare these skills and content to teaching with which they are most familiar (their own) in order to respond to the question item and determine if they perceived the skill or content is better addressed by project-based learning or not. The Qualtrics Survey System was used to analyze frequency of this data. The frequency data was compared to the last open-ended data supporting this question. The open-ended data was organized using the typology system to identify patterns and relationships that corresponded to the associated close-ended data.

4.0 STUDY FINDINGS

This chapter presents the results of the research to examine 1) what teachers perceived to be the challenges of implementing project-based learning, 2) how teachers address these perceived challenges and, 3) the perceptions teachers have of the role of 21st Century skills in project-based learning. The chapter is organized into three main sections, the first of which describes the purpose of the study and a description of how was implemented. This section is a follow up to the study design plan identified in chapter 3, Study Design. The second section will address the demographic and contextual data collected through the study. This section will identify response rates for grade-level of teacher, subject taught, years' experience, and the frequency of type of project-based learning experience implemented by the teachers. This section will also address general feelings about project-based learning and serve as foundational data upon which to examine the data gathered on the research questions themselves. This last section of the chapter will address the three research questions in turn: 1) What challenges do teachers perceive they face when implementing project-based learning? 2) What ways do teachers respond to these challenges? 3) What are teachers' perceptions about project-based learning as a way to teach 21st Century skills? through an analysis and interpretation of both the mixed and opened question items using the data analysis methods identified in chapter 3.

4.1 HOW THE STUDY WAS CONDUCTED

The goal of this study was to collect data on teachers' perceptions on the implementation of project-based learning in order to shed light on the complexities associated with implementing project-based learning. The resulting analysis and interpretation of the way teachers perceive to be the challenges and how they respond to these challenges could be used to make decisions regarding implementation plans or design of project-based experiences. The purpose of collecting data on the role of 21st Century skills in project-based learning is to better understand the meaning of these skills and outcomes within project-based learning experiences. An interpretation of this data may lead to determine the degree to which teachers believe project-based learning is a desirable approach to address the educational needs of future generations of students.

In order to collect data on these elements, a questionnaire was developed comprised of mixed question types. According to survey research literature, open-ended question items can capture data too complex for closed items (Converse & Presser, 1986). For this reason, open-ended items followed closed questions in order to gather perception data from different approaches. The questionnaire was comprised of three main sections: 1) a section on demographics and background information that helped frame the context for other data associated with the study, 2) a section on teachers' responses to the challenges of project-based learning and how they respond to these challenges and, 3) a section on the data associated with of 21st Century skills in project-based learning.

The research population was comprised of 101 teachers from a suburban middle school outside of Pittsburgh, PA who have implemented various types of project-based learning experiences for the past three years. Because past grade-level project-based experiences have

mostly involved core subject teachers, it was assumed that not all staff members would choose to respond to the questionnaire. Though all 101 teachers were offered the opportunity to participate in the study, 49 of them chose to do so. Of the 101 teachers, 49 are core team teachers who have had the most direct experience with the grade-level project-based experiences. The questionnaire was offered to the entire staff, however, in the event that other classroom and team-level project-based learning experience data could have been gathered from any of the 101 teachers at the school.

The questionnaire was distributed through the Qualtrics Survey System via hypertext link in an email to the staff. Before the questionnaire was distributed, the researcher met with the administration at the school to discuss the distribution method and timeline including specific dates for an in person introduction to the staff and follow up procedures.

The original procedures for administering the study were to do so electronically and use the in person meeting as the follow up method. Conversations with the building administration involved possible dates, times and, based upon these, ways to introduce and distribute the questionnaire to the staff. After discussion with the building administration, it became necessary to adjust the original procedures for introducing and following up on the study. The study was introduced to the staff at a meeting before an in-service professional development session before electronic distribution. The building administration felt that this in-service provided an opportunity where the entire staff would be gathered in one place and allow for a window of time afterward for completion of the questionnaire. Follow up procedures changed to an electronic reminder in the form of an email containing the questionnaire link and a review of the study's goals.

4.2 DEMOGRAPHIC AND CONTEXTUAL DATA

The demographic and general questions about project-based learning form a contextual framework within which to better understand the study of the three research questions. These questions describe the roles and experience of the teachers responding to the questions and their general feelings about project-based learning.

Table 6 - Respondents' Assigned Grade-Level

Grade Level		Number of Responses	%
6		19	39%
7		24	49%
8		21	43%

Of the 101 teachers who were given the opportunity to respond, 49 chose to do so. Table 6 represents the breakdown of grade level of teachers who responded. In some cases, teachers who teach multiple grades indicated as such in response to the question. Total response percentage is more than 100% because of multiple grades indicated for the question. Though most respondents (49%) were 7th grade teachers, the other grades are represented well in the data. Actual response numbers show just a deviation of 5 teachers for 6th grade and 3 teachers for 8th grade.

Table 7 - Respondents' Years Teaching Experience

Years' Experience		Number of Responses	%
1-5		2	4%
6-10		9	18%
11-15		12	24%
16-20		9	18%
21-25		11	22%
26-30		4	8%
30+		2	4%
Total		49	100%

A similar disbursement is seen in the years of teaching, Table 7, and assigned subjects, Table 8. The table represents the years' experience, the number of responses and the percentage of responses. The results are presented with these categories to demonstrate the range of years' experience represented by those responding to the questionnaire.

Most of the teachers responding to the questionnaire have been teaching for 11-15 years (24%), yet this response category was just slightly higher than the 21-25 years of teaching range (22%) and this range was only slightly higher than the 16-20 years of experience range (18%). This response category matched that of the 6-10 years of experience range (18%). In all, the greatest difference of years' experience occupied the extreme ends of the response options, either teachers just starting their careers or the most veteran teachers with 26 or more years' experience. By far, the range of respondents had 6-25 years of experience and the deviation among these years of experience was no greater than 6%.

Table 8 - Subjects Taught by Respondents

Subject Taught		Number of Responses	%
Language Arts		6	12%
Mathematics		8	16%
Social Studies		5	10%
Science		8	16%
Reading		7	14%
Special Education		2	4%
Other		13	27%
Total		49	100%

The study also collected data on the subjects the respondents teach. All core subjects (Language Arts, Science, Social Studies, Mathematics, and Reading) were listed as options as well as Special Education. "Other" served to capture data on any other subject taught by the respondents with a text field available to specify the subject. Table 8 represents the disbursement of subjects taught by the respondents in order to understand the range of subjects taught by the respondents. Though most respondents indicated they were teachers in the "other" category, that is, a non-core subject teacher, this category cannot be considered the most represented group since this "group" includes 8 different subjects: Business, Technology Education, Art, Gifted Education, Music, Library, and World Languages. With this in mind, the responses indicated an even disbursement over the range of subjects, except for special education (4%). The small number of special education teachers (13) who could have responded to the questionnaire explains the lower response rate in this subject. All other subjects deviate by no more than 6% or 3 respondents.

Overall, the demographics for grade, years' experience and subject taught all show a surprisingly narrow disbursement across the data. This would seem to indicate participant group

that is representative of the population of teachers at the middle school; there does not seem to be any group not represented in the study's data.

Table 9 - General Opinion about Project-based Learning

General Opinion		Number of Responses	%
Very positive		8	16%
Generally positive		24	49%
Mixed: About equally positive and negative		15	31%
Generally negative		2	4%
Very negative		0	0%
Total		49	100%

Beyond the three research questions, one of the purposes of the study was to gather general perception information about project-based learning. This data would serve as a context for understanding the other data represented in the study relative to the three research questions. If teachers were either extremely positive or extremely negative about project-based learning in general, then this general perception would play a role in interpreting other questions asked about project-based learning. Table 9 represents data associated with general perceptions of project-based learning. The teachers were asked to identify their general opinion of project-based learning as an approach to teaching and learning relative scale ranging from "very positive" to "very negative" in order to gain insight into the respondents' basic perception of project-based learning.

Of the 49 teachers who responded to this question, most had an opinion about project-based learning that was positive, either generally positive (49%) or very positive (16%). Thirty-one percent were neutral in their consideration of project-based learning as an approach to

teaching and learning. Very few felt negative; only 4% or 2 respondents indicated an opinion that was "generally negative." No teachers responded that they were of the "very negative" opinion regarding project-based learning.

Since most respondents (80%) were either mixed in their opinion of project-based learning as an instructional approach or "generally positive," the data seems to indicate that the participant group does not hold an extreme position on project-based learning. This middle position is similar to the phases or stages of implementation described in selected literature on implementation in schools (M. Fullan & Pomfret, 1977; George et al., 2006; Vrakking, 1995). Vrakking (1995) describes an "Initiation" and "Implementation" phase where information on the innovation has been disseminated and teachers have begun to accept the changes associated with the innovation before entering the actual "Implementation Phase" (p. 32). Fullan and Pomfret (1977) write of "five dimensions of implementation" in which teachers undergo changes in role/behavior and knowledge and understanding (p. 336). The respondents' responses were in the middle of the scale in relation to their opinion of project-based learning, which may indicate that they are in the middle phases or stages of implementation as described by Fullan and Pomfret (1977) and Vrakking (1995).

Table 10 - Frequency of Type of Project-based Learning Experience

Type of PBL	0 times	1 time	2 times	3 times	5 times	More than 5 times	Total Responses
Classroom PBL	8	8	8	3	2	10	39
Team PBL	18	11	3	2	1	2	37
Grade-level PBL	6	7	27	7	0	0	47
Whole-school PBL	23	6	4	1	0	0	34

Teachers were also asked to identify the type of project-based learning experience in which they participated by identifying a frequency count for each type. In order to gather data based upon a similar understanding, the questionnaire provided a definition of project-based learning derived from selected literature (Bender, 2012; Markham et al., (2003).

The researcher was aware of several grade-level project based experiences reportable by many teachers, especially the core subject teachers. What was not known, however, was the frequency of the other types of project-based experiences in which the teachers participated. Table 10 represents types of project-based learning experiences and the number of times participants engaged in that type of project-based learning design. The total number responses for each type of project-based learning experience were analyzed to determine the type of project-based experience the participants engaged in most and least often. As Table 10 shows, most teachers (47) indicated that they participated in grade-level project-based experiences. However, this response category was closely followed by team-level project-based (37) experiences and classroom-level project-based experiences (39) respectively. Interestingly, classroom-based experiences garnered the second highest of all types of project-based experiences. This could indicate that most teachers participated in single subject project-based

experiences since teachers would most likely choose "team-level" project-based experiences if they were collaborating with other teachers from other content areas.

4.3 RESEARCH QUESTION NUMBER ONE: PERCIEVED CHALLENGES OF PROJECT-BASED LEARNING

What challenges do teachers perceive they face when implementing project-based learning?

Project-based learning involves a change from traditional methods of instruction (Bender, 2012; Markham et al., 2003). Because of this, teachers who implement the approach are often faced with challenges specific to the implementation of project-based learning. Research question one seeks to explore the perceptions teachers have about what challenges them the most when implementing project-based learning. In order to gather data on this phenomenon, the questionnaire asked respondents to rank their perception of what challenges them from most to least when implementing project-based learning. Following this closed question type was an open response field in which teachers could expand upon their responses in the previous closed item. The construction of the question used a set list of challenges of implementing project-based learning identified through selected literature.

Bender (2012), for instance, identifies design of a project-based unit of instruction as a challenge and suggests that some may feel more comfortable with a partner or choosing to "use PBL as an adjunct to their unit-based instruction" (p. 38-39). Bender (2012) as well as Markham et al., (2003) both see the changing role of the teacher to that of facilitator of instruction as a possible challenge for some. Bender (2012) and Markham et al., (2003) also identified design,

time and the level of student engagement or involvement as a possible challenge for some teachers. Markham et al., (2003) addresses the challenges of meeting accountability standards, building structure, and management of student groups and the project itself (p. 8-11). Other selected literature identify the school assessment of project-based learning as challenging for some teachers since the learning experiences associated with project-based learning are often group-based, cross-curricular and multifaceted (Bell, 2010; Bender, 2012; Boss, 2012; Colley, 2008; Solomon, 2003).

Table 11 - Perceived Challenges Implementing Project-based Learning

Challenges	1	2	3	4	5	6	Total Responses
Time to plan and implement	0	1	10	12	26	0	49
Meeting all of the testing accountability requirements	0	5	7	14	21	2	49
Implementing the project within the school's schedule	0	10	3	15	20	1	49
Fitting all of the standards	4	6	9	13	17	0	49
Designing the project	3	9	8	17	10	1	48
Assessing the project to determine a grade	3	7	16	12	11	0	49
Creating the project (coming up with the idea)	3	12	8	13	12	0	48
Managing the entire project	4	10	14	13	8	0	49
Helping parents understand the project	9	13	13	9	3	2	49
Collaborating with other teachers	11	17	6	8	3	4	49
Managing the student groups	9	13	18	7	2	0	49
Shifting from directing the instruction to facilitating more group work	9	15	18	6	1	0	49
Co-teaching with other teachers	18	12	9	4	1	5	49

The challenges teachers perceived to be most challenging when implementing project-based learning were "Time to implement," "Meeting all of the testing accountability requirements," "Implementing the project within the school's schedule," "Fitting all of the standards," and "Designing the project" as the top five they perceived to be most challenging.

Table 11 represents the data of perceived challenge and is sorted highest to lowest in order to determine the challenges teachers perceived as most challenging and least challenging when implementing project-based learning.

Of the 49 respondents, 26 identified "Time to implement" at the highest level of perceived challenge. Closely following this was "Meeting all of the testing accountability requirements" and "Implementing the project within the school's schedule." All three of these responses recorded 20 or more teachers indicating the highest level of perceived challenge. Of the lowest perceived challenges, teachers recorded "Co-teaching with other teachers," "Shifting from directing the instruction to facilitating more group work," and "Managing student groups." Of these, co-teaching had the most responses (18) in the "least" challenging response category. The only other response with a double-digit response rate in the "least" challenging category was "Collaborating with other teachers." Clearly, the idea of working with other staff is not perceived as a challenge to most respondents.

"Meeting all of the testing accountability requirements" and "Fitting in all the standards" are two related items that received high numbers of rankings of 4 and 5 – the perceived "most challenging" indicator. These responses seem to suggest a concern over state mandates and how project-based learning would perform as a method of meeting them. Selected literature addresses the concern of meeting state accountability standards (Bender, 2012; Markham et al., 2003). Markham et al (2003) write of the need to create "standards-focused" project-based experiences that "fit well with the era of accountability and performance" (p. 5).

4.3.1 Analysis of the Open-ended Data for Research Question One

The open-ended item following the perceptions of challenges question were analyzed using the Hatch's (2002) Typology method. In this method for open responses, typologies are identified upon which to review the data, the data are marked and coded according to these identified typologies to look for themes and relationships among the data, and one-sentence generalizations are written to represent the main themes. Selected excerpts support these one-sentence generalizations directly from the responses.

The initial typology identified for the open-ended item associated with the perceived challenges question was "Rating on PBL Challenges." The individual challenges listed in the question were determined by a review of selected literature (Bell, 2010; Bender, 2012; Boss, 2012; Markham et al., 2003; G. Solomon, 2003). The listed challenges became the more specific typologies for this question and from these, themes emerged upon which the interpretation of the results was based.

Analyzing the data under these typologies, four themes emerged: Design, Accountability and Standards, Collaboration, and Time. The themes were coded in the data using the following codes: Accountability and Standards (A), Collaboration (Code C), Design (Code D), and Time (Code T). In some cases, responses indicated more than one theme and required more than one code. In other circumstances, one theme was often matched with another and, thus, coded as one theme. For instance, comments associated with Accountability and Standards (Code A) were often mentioned together and coded together as one theme.

Accountability and Standards (Code A): Participants who responded under the "Accountability and Standards" (Code A) theme, indicated some degree of concern with "fitting in" standards, individual student accountability or meeting state accountability measures and

standards. In support of this generalization, one respondent indicated, "I think covering the Common Core Standards in a way that can be done in conjunction with PBL is a challenge."

Collaboration (Code C): Participants who indicated a response associated with Code C – Collaboration wrote of the challenges of grouping students, the dynamics of student roles in groups and managing groups. "Grouping of students," one respondent wrote, "leaders take charge – others try and be on the sidelines. All encouraged to work, as always and with any group work – not all give 100%."

Design (Code D): Participants who responded within the Design (Code D) theme wrote of the challenges of working with the structure of project-based learning units including the need to make authentic connections or finding ways to include direct instruction when needed. A participant who responded in the theme category wrote, "Materials to implement; finding experts in the field and getting them to the school together, not seeing PBL in action at a different location with experienced teachers."

Time (Code T): Participants who responded according to the Time (Code T) theme indicated several challenges associated with time including time to meet with peers and time to plan the project-based learning experience. "Having time to meeting with peers," one participant wrote. "Team meeting alone does not cut it."

The open-ended responses were reflective of the top five perceived challenges, "Time to plan and implement," "Meeting all of the testing accountability requirements," "Implementing the project within the school's schedule," "Fitting all of the standards," and "Designing the project." The open-ended section of the questionnaire for this item allowed for elaboration on each of the top five perceived challenges. The elaboration indicates a degree of concern for the implementation of project-based learning when influenced by structures outside the actual design

of the project, like the school's schedule or state mandated standards and testing. The details with which teachers responded to these challenges are yet another data source in analyzing the perceived challenges and could be used to guide future implementations of project-based learning.

4.4 RESEARCH QUESTION NUMBER TWO: HOW TEACHERS RESPOND TO PERCIEVED CHALLENGES

What ways do teachers respond to these challenges?

Research question two is dependent upon the responses in the perceived challenges question. It seeks to explore they ways in which teachers would address the challenges they indicated in the previous question. The goal of this research question is to determine common themes that surface in the responses to how teachers respond to the challenges of implementing project-based learning. These themes of responses will inform discussion of how teachers might respond to the challenges associated with future implementations of project-based learning.

Table 12 - Perceived Challenges

Challenges
Collaborating with other teachers
Co-teaching with other teachers
Shifting from directing the instruction to facilitating more group work
Time to plan and implement
Creating the project (coming up with the idea)
Designing the project
Managing the student groups
Managing the entire project
Helping parents understand the project
Fitting all of the standards
Meeting all of the testing accountability requirements
Implementing the project within the school's schedule
Assessing the project to determine a grade

The question was constructed in the form of text fields associated with each perceived challenge identified in the previous question. Respondents considered the challenges they indicated in the previous question and wrote about how they respond to these challenges. The challenges upon which respondents reflected are identified in Table 12.

4.4.1 Analysis of Research Question Number Two

The main typology originally identified was "Responses to Challenges." Within this typology, themes emerged from each challenge further clarifying the analysis within each "responses to challenges" response category. Generalizations were drawn from these groupings of themes in each response category and representative statements identified and recorded.

Table 13 - Responses to Challenges and Related Themes

Challenges	Themes
Collaborating with other teachers	• Finding extra time (Theme 1) • Use of current resources (Theme 2) • Challenges of finding time to collaborate (Theme 3)
Co-teaching with other teachers	• Intrapersonal (Theme 4) • Schedule and time flexibility (Theme 5)
Shifting from directing the instruction to facilitating more group work	• Concern over change (Theme 6)
Time to plan and implement	• Time outside of the school day (Theme 7) • Challenges with finding time (Theme 8)
Creating the project (coming up with the idea)	• Using available resource, including other teachers (Theme 9) • Challenges of generating the idea (Theme 10)
Designing the project	• Using resources including other teachers (Theme 11) • Focusing on elements of PBL (Theme 12)
Managing the student groups	• Specific goals of student groups (Theme 13) • Challenges of grouping students (Theme 14)
Managing the entire project	• Organization strategies (Theme 15) • Using time effectively (Theme 16)
Helping parents understand the project	• Methods of informing (Theme 17)
Fitting all of the standards	• Choosing relevant standards (Theme 18) • Adjusting or designing the project to meet standards (Theme 19) • Comments on challenges of meeting the standards (Theme 20)
Meeting all of the testing accountability requirements	• Comments on challenges of meeting requirements (Theme 21) • Suggestions for meeting requirements (Theme 22)
Implementing the project within the school's schedule	• Need for flexible schedule (Theme 23) • Schedule incongruent with project-based learning (Theme 24)
Assessing the project to determine a grade	• Rubrics (Theme 25) • Comments on challenges of grading (Theme 26)
Open-ended Item	• Suggestions (Theme 27) • Statements of challenge (Theme 28)

Source: Created by the author

Collaborating with other teachers: The emerging themes from responses in this category include "finding extra time" (Theme 1), "use of current resources" (Theme 2) and "challenges of finding time to collaborate" (Theme 3). Of these, "finding extra time" (Theme 1) seem more prominent than the other themes and included statements about use of current time built into the

schedule or the need to add additional time to collaborate. Representative statement: "Finding common time to to [sic] really plan a unit – from start to finish."

Co-teaching with other teachers: The emerging themes from responses in this category were "intrapersonal" (Theme 4) and "schedule and time flexibility" (Theme 5). The responses for this "responses to challenges" category indicated that participants were concerned with the flexibility of co-teachers as well as the flexibility of the schedule to allow for time or the opportunity to collaborate. Representative statement: "Scheduling to get co-teachers. Finding coverage when they are co-teaching." "Flexible, compromise."

Shifting from directing the instruction to facilitating it: There were very few responses to this "responses to challenges" category. Of those responses, "concern over change" (Theme 6) seemed to be the most prevalent theme. Representative statement: "I think to give up a certain level of control is nerve-wracking. I think this is just something personally I need to work through."

Time to plan and implement: Themes in the category included "time outside of the school day" (Theme 7) and "challenges with finding time" (Theme 8). The challenge of time was reflected in the comments in this section and included the need to find extra time or the difficulty of finding extra time to implement project-based learning. Representative statement: "A true PBL takes a great deal of time to plan. In today's schedule, there is limited time for all the teachers involved in the planning to meet, discuss and plan."

Creating the project (coming up with the idea): Themes associated with this response category include "using available resource, including other teachers (Theme 9) and "challenges of generating the idea" (Theme 10). The data suggested that teachers know resources in order to create a project idea for project-based learning experiences, but are also aware of the challenges

in doing so. Representative statement: "There are resources out there, but finding one that exactly fits is difficult. Any project needs to be modified to your school/classroom needs."

Designing the project: Themes associated with this response category include "using resources including other teachers" (Theme 11) and "focusing on elements of PBL" (Theme 12). Respondents indicated brainstorming with other teachers was a response to the challenge of designing a project-based learning experience. Some responses also indicated a need to focus on elements of project-based learning like establishing a good driving question. Representative statement: "Accounting for all of the necessary elements, tasks, etc. and making sure the inquiry is rigorous and sustained."

Managing the student groups: Themes associated with this response category included "specific goals of student groups" (Theme 13) and "challenges of grouping students" (Theme 14). Responses in this category either address the purpose of establishing student groups (i.e., to meet readiness levels) and problems associated with establishing groups. Representative statement: "determining the best groupings and meeting the readiness levels of all within the PBL experience."

Managing the entire project: Themes associated with this response category include "organization strategies" (Theme 15) and "using time effectively" (Theme 16). Responses indicated either ways to organize the project, like using technology or a focus on ways to organize the time, like using a calendar to map out the project. Representative statement: "A time line has to be adhered to so that it doesn't take up too much time."

Helping parents understand the project: There were few responses in this category. Those that responded indicated "methods of informing" (Theme 17) as ways to address the "Helping parents understand the project" challenge. Representative statement: "Parents question

everything. Choosing how you word your question to who you group their child with. The necessity of the project? Be ready to defend."

Fitting all of the state standards: Themes associated with this response category include "choosing relevant standards" (Theme 18), "adjusting or designing the project to meet standards" (Theme 19), and "comments on challenges of meeting the standards" (Theme 20). Though participants responded with comments about how fit the standards into a project-based learning experience, often these statements were coupled with a statement about how difficult it is to do so. Representative statement: "This is the idea that I am most concerned with. I need to find a way to navigate the standards within the context of Common Core. This comes down to specific planning. I need to take a close look at the PBL projects and the Common Core."

Meeting all of the State testing accountability requirements: Similar to the "fitting all of the State standards" response pattern, the statements in this response category often coupled a suggestion on how to meet accountability requirements with a comment about challenges of doing so. The themes associated with this response category include "comments on challenges of meeting requirements" (Theme 21) and "suggestions for meeting requirements" (Theme 22). Representative statement: "I have to design the project and keep adjusting it to fit the standards, which is not ideal!!! We are still teaching to the standards even if it is project based."

Implementing the project within the school's schedule: Themes associated with this response category included "need for flexible schedule" (Theme 23) and "schedule incongruent with project-based learning" (Theme 24). Respondents indicated the difficulty of finding the time to implement project-based learning experiences within the schedule. When respondents offered a response to this challenge, often the comments had to do with flexing the schedule's

structure or making better use of time available. Representative statement: "being flexible with scheduling, allowing staff to participate in areas of interest."

Assessing the project to determine a grade: Themes associated with this response category include "rubrics" (Theme 25) and "comments on challenges of grading." (Theme 26) In most instances, respondents indicated either a suggestion for how they assess the project-based experience or commented on challenges of doing so. In some cases, respondents combined a suggestion with a statement of challenge. Representative statement: "I find it difficult to give an individual score for a group project. To address this, I try to have as many one on one meetings as I can to assess progress. I also give individual components (like journals) to help determine scores."

In addition to the text fields capturing data specific to each perceived challenge, respondents also had the opportunity to add additional ways they responded to the challenges of implementing project-based learning. The themes that emerged from the open-ended item following the grouped responses include "suggestions" (Theme 27) and "statements of challenge" (Theme 28). In some cases, respondents included comments about the challenge implementing project-based learning in the context of the school (schedule, other responsibilities) or education (meeting testing requirements). Representative statement: "Collaboration, communication, and flexibility with all parties – very important – with parents, fellow teachers, students." The table below identifies the themes relevant to each response category.

4.5 RESEARCH QUESTION NUMBER THREE: PERCIEVED ROLE OF 21ST CENTURY SKILLS

What are teachers' perceptions about project-based learning as a way to teach 21st Century skills?

Research question three explores the perceptions teachers have about the role of 21st Century skills in project-based learning. Selected literature suggest that 21st Century skills, as defined by the Partnership for 21st Century Skills (p21.org), can be acquired through project-based learning experiences (Alsop-Cotton, 2009b; Barell, 2010; Bell, 2010; Bender, 2012; G. Solomon, 2003). Specifically, this research question seeks to determine the degree to which teachers believe 21st Century skills are better taught through the use of project-based learning. Teachers' perceptions on this focus may help implementers of project-based learning understand the value of 21st Century skills as learning outcomes for students. The degree to which teachers see project-based learning as a purveyor of 21st Century skills may help future implementers design project-based learning experiences that focus on these skills.

Table 14 - Perceived Role of 21st Century Skills

21st Century Skills	Completely Agree	Generally Agree	About the same	Generally disagree	Completely disagree	Total Responses
Productivity and Accountability	5	18	17	7	1	48
Social and Cross Cultural Skills	8	15	20	5	1	49
Creativity and Innovation	13	28	7	1	0	49
Critical Thinking and Problem Solving	21	17	10	1	0	49
Communication and Collaboration	16	26	5	2	0	49
Information, Communications and Technology Literacy	12	24	12	1	0	49
Flexibility and Adaptability	12	25	11	1	0	49
Initiative and Self-Direction	12	17	16	3	0	48
Leadership and Responsibility	11	19	16	3	0	49

In order to gather data on this question, participants identified the degree to which they agreed that project-based learning did a better job teaching specific 21st Century skills. Table 14 represents the responses by degrees of agreement according to the 21st Century skills listed. To analyze this data, total responses were added to determine the highest and lowest agreement category for each 21st Century skill.

Forty-eight to 49 participants responded to this question item. When analyzing the number of times respondents indicated a response category for all skills combined, most responses fell into the "generally agree" response category with 189 total indications of agreement in this category. One hundred and fourteen indicated they felt project-based learning taught 21st Century skills "about the same" as other methods of teaching. 110 indicated they "completely agree" that project-based learning does a better job teaching 21st Century skills. Twenty-four respondents indicated "generally disagree" responses and 2 respondents indicated they "completely disagree" project-based learning does a better job teaching 21st Century skills.

Of all the skills listed, "Communication and collaboration" had the highest responses of "generally agree" and "completely agree" (42). "Creativity and innovation" received the second highest "generally agree" and "completely agree" responses (41). "Critical thinking and Problem solving" received the third highest responses in this response category (38). The skills that received the most "generally disagree" and "completely disagree", were "Productivity and accountability" (8) and "Social and cross-cultural skills" (6). No other skills received any "completely disagree" responses.

Since most responses were in the "generally agree" response category, it is prudent to analyze the responses in this response category. "Creativity and innovation" received 28 responses in this response category, followed closely by "communication and collaboration" at 26 responses. "Flexibility and adaptability" and "Information, communications and technology literacy" received the third and fourth highest responses respectively in the "generally agree" response category (25, 24).

The high number of responses (189) in the "generally agree" response category is consistent with the number of teachers indicating that they feel "generally positive" about project-based learning in general. For this question, 49% of the respondents indicated responses in the "generally positive" response category.

4.6 ANALYSIS OF THE FINAL OPEN-ENDED QUESTION

The final question of the questionnaire asked participants to respond to an open-ended question. This question gave participants the opportunity to add any other thoughts regarding the three research questions. Eight of the 49 respondents chose to do so. Though "21st Century

skills" was the typology chosen to analyze the data in this question, more specific themes emerged after reviewing the data.

Participants responded to this question according to two themes, "implementation suggestions" (Code I) and "challenges to the concept" (Code C). The responses that were reflective of "challenges to the concept" wrote comments about the difficulties implementing aspects of project-based learning or challenging the concept in general. Representative of this theme, one respondent wrote, "Just because one group things [sic] something is a good idea does not mean it is. Academics have changed, but the basic foundation of education is still the same." Responses reflective of the "implementation suggestions" theme addressed suggestions or comments on how to implement project-based learning more effectively. Reflective of this theme, one respondent wrote the following: "Time should be taken to establish a strong skill set to ensure efficiency and success in their efforts toward problem solving. Some problem-solving measures are more efficient and effective than others."

4.7 CONCLUSION

Project-based learning involves a departure from traditional modes of teaching. Students tend to work in groups and teachers move from directing the instruction and learning to facilitating the inquiry experience. Often the kind of learning the students engage in will require more time and different resources and materials (Barell, 2010; Bender, 2012). Because of these traits, implementing project-based learning can push against established teaching methods and school organizational structures.

The study's design included data collection procedures to explore the point at which teachers begin to change current practice in favor of those required by a project-based learning implementation. The study was able to discern how and the degree to which teachers are challenged by implementing project-based learning. The study also collected data on how teachers respond to these challenges for the potential benefit of other teachers who would like to implement the approach. The study also discerned how and the degree to which 21st Century skills play a role in project-based learning, again, for the benefit of other teachers who need to know the value of 21st Century skills in project-based learning experiences. The following chapter will explore to a greater degree what this data means and what implications it may have for future research.

5.0 INTERPRETATION AND DISCUSSION

The purpose of this study was to examine the perceptions teachers have when implementing project-based learning. To do so, the study used three research questions to guide the inquiry. The first question examined the perceptions teachers have concerning the challenges they face when implementing project-based learning. The second question explored their responses to these challenges. The third question explored the role 21st Century skills, as defined by the Partnership for 21st Century skills (p21.org), plays in project-based learning. The results of the study could help future implementers of project-based learning understand some of the pit falls of doing so and how to address these challenges in addition to helping future implementers understand the value of 21st Century skills in project-based learning in order to better address these skills in the experiences the teachers design. The specific research questions were as follows:

1. What challenges do teachers perceive they face when implementing project-based learning?
2. What ways do teachers respond to these challenges?
3. What are teachers' perceptions about project-based learning as a way to teach 21s Century skills?

The previous chapters of this document established a purpose for studying project-based learning including why it is significant to do so and how the researcher came to be interested in the topic. The chapters also reviewed literature associated with the historical and theoretical background of project-based learning as well as selected literature on the definition and elements

of project-based learning and the efficacy of the approach. Finally, a description of the methods for collecting data on the research questions was presented including a description of the data collection tool and procedures to collect and analyze the data once collected. The following sections of this document will address interpretations that resulted from the analysis of the collected data, any limitations associated with the study, and suggestions for further research.

5.1 SUMMARY OF FINDINGS

Project-based learning can draw its lineage back to not only theoretical work of some of education's most famous theorists but also historical events that sparked a series of following events leading to an increased interest in project-based learning (Dewey, 1938; Flynn, 1995a; Friel, 2005; Piaget, Jean, 1973; Vygotskiĭ & Cole, 1978).

The leaders of the United States of America sought immediate answers to the question of how to beat the Soviet Union in the space race after Sputnik reached its apogee and orbited the earth. They codified the response through the National Defense Education Act of 1958. This act refocused the educational community on developing stronger math and science students and by identifying the best and brightest in our nation's schools (Ebert Flattau et al., 2006; Flynn, 1995b).

Following this effort, the U.S. passed another law to establish clear standards for the education of the nation's students and provide funding for schools with larger populations of low socio-economic status. The Elementary and Secondary Education Act of 1965 eventually lead to a standards movement where each state became required to set standards for what students should know and be able to do and establish testing measures to assess student progress on these

standards. Later reauthorizations of this law, most prominently No Child Left Behind of 2001, added unprecedented accountability and punitive measures for schools not meeting benchmarks in state testing for sub groups of students (Barton, 2001; "Elementary and Secondary Education Act of 1965," 2009; Lewis, 2002b).

This law was in response to the dramatic reports of the loss of the earlier gains realized through the National Defense Education Act of 1958. One report, *A Nation at Risk: The Imperative for Educational Reform*, outlined the sharp drop in student achievement especially compared to other nations. The authors saw the state of the American educational system as a national security risk, stating, "We have, in effect, been committing an act of unthinking, unilateral educational disarmament" ("A Nation at Risk : The Imperative for Educational Reform," 1983, p. 9). The report also included recommendations to address the problems and called on schools develop a system where students are taught to "respond to the challenges of a rapidly changing world" (p. 14).

The Council of Chief State School Officers and the National Governors Association developed the Common Core State Standards in order to unify the each state under one set of standards designed to help students gain the skills and learning they need to be ready for college and careers. "In particular," they state, "problem-solving, collaboration, communication, and critical-thinking skills are interwoven into the standards" ("Common Core State Standards Initiative," n.d.). These same skills are those identified at the "Learning and Innovation" skills found in the Partnership for 21st Century Skills framework that identifies the "4Cs" as "critical thinking and problem solving, communication and collaboration, and creativity and innovation." Selected literature reviewed draws connections between these skills and project-based learning (Alsop-Cotton, 2009b; Barell, 2010; Bell, 2010; Bender, 2012; Gut, 2011).

The selected literature also established defining characteristics of project-based learning that meshed well with the goals of the Common Core State Standards and 21st Century skills. The common elements associated with project-based learning were explored through the selected literature including the problem solving characteristics of the approach, the collaboration involved and the authentic inquiry around a driving question (Bell, 2010; Bender, 2012; Markham, 2011; G. Solomon, 2003). The connection to standards and 21st Century skills indicated some degree of learning efficacy from project-based learning implementations. The study also explored the selected literature on this topic and found some correlation to project-based learning and achievement, student engagement and long-term memory (Boaler, 1998b; Grant, 2011; Thomas, 2000).

The study employed a questionnaire to collect data on how teachers perceived the project-based learning, challenges they face, ways they respond, and the role of 21st Century skills. This questionnaire included both closed and open items to complete data relative to the three research questions. The study included a description of the methods and procedures to collect the data including introduction of the study to the participants and follow up and data analysis procedures. Data was analyzed by using the Qualtrics Survey System for data from closed items and Hatch's (2002) typology method for open data and provided detail of the teachers' perceptions and experiences when implementing project-based learning.

The data collected in this study reflect the tension teachers experience when implementing project-based learning. The data on the challenges teachers perceive they face when implementing project-based learning revealed that the teachers perceived time, meeting standards, meeting accountability expectations, implementing within the school's schedule and design as the factors they perceived were most challenging. Of these challenges, all but

"designing the project" is related to organizational structures or requirements outside the actual creation or implementation of the project-based learning experience. The teachers' responses to these challenges were reflective of perceived difficulty implementing in the context of these outside organizational structures, like the school's schedule or meeting state testing requirements.

The 21st Century skills selected by the participants, critical thinking and problem solving, communication and collaboration, received the highest number of responses of "generally agree" and "completely agree" and indicated an awareness of the value of these skills in implementing project-based learning. The data from the last open item revealed continued concern implementation practices or project-based learning itself and open the opportunity for further discussion and interpretation.

5.2 INTERPRETATION OF FINDINGS

The review of selected literature revealed a historical lineage starting from Sputnik to the use of project-based learning. Beyond this, the selected literature has uncovered the theoretical foundations of project-based learning found in the work or Dewey (1938), Piaget (1973) and Vygotski (1978). The value of these connections is the understanding that project-based learning has not just sprung up as some new instructional trend, but based upon historical events and theoretical works of significance. Despite this, teachers struggle with the implementation of new initiatives.

Though seen to be more effective in these ways, teachers still perceive challenges when implementing project-based learning despite the study's finding that teachers feel generally

positive about the approach. This study found that the challenges they perceived to be most impacting were time, meeting the states accountability requirements, fitting in the standards, implementing within the school's schedule, and design of the learning experience itself. Most of these challenges are influenced by organizational structures outside the actual design or implementation of project-based learning in the classroom. This may indicate that their own beliefs about project-based learning or their ability to implement the components of project-based learning are not the main concern of the teachers. They may philosophically believe in the approach, but struggle to implement it in light of outside pressures.

The participants' responses to these challenges were reflective of the pressure from outside sources. The comments that addressed the challenges did so in ways that addressed the outside barriers. Teachers indicated the need to find more time out of the regular schedule, for instance, as a way to respond to the challenge of time to plan and implement project-based learning. Additionally, teachers indicated how they used resources available to them, especially collaboration with other colleagues. The responses indicated the teachers valued collaboration despite the difficulty finding time to do it.

The responses to the challenges were often laced with additional comments about the outside influences. Though designed to collect only information about how they respond to challenges, the open construct of the question allowed for teachers to expand upon how they respond to the challenges they face. One representative participant responded in this way: "With so much testing and other schedule limitations it is worrisome to add something so time-consuming and labor-intensive. The PBL needs to be conducted with great focus and motivation. Giving these short shrift could result in the PBL failing to bring about the desired results." The fact that they continued to express concern over the challenges in a question

designed to collect data on responses to the challenges may indicate that many teachers were keenly influenced by outside pressures. The responses may also indicate that teachers lacked the knowledge on how to respond to the challenges.

The participants revealed through the collected data that they perceive project-based learning to be better at teaching some 21st Century skills. Of those skills, critical thinking and problem solving, communication and collaboration received the highest number of responses of "generally agree" and "completely agree." The data are consistent with those skills identified by the Partnership for 21st Century skills as the "4C's" or the "Learning and Innovation Skills," which they state are "essential to prepare students for the future" (Partnership for 21st Century Skills, n.d.).

The fact that respondents indicated the same skills as those central to the framework for 21st Century skills supports the correlation between project-based learning and the acquisition of 21st Century skills. This correlation is also supported in the literature. Authors write of the need for students to acquire the skills necessary for the modern work force (Barell, 2010; Pearlman, 2006). The literature also suggest that project-based learning is the means to teach these skills and better prepare students for the types of tasks required of them in future work places. The review of literature demonstrated the connection between the skills and elements of project-based learning that teach them (Barell, 2010; Bell, 2010; Bender, 2012; Boss, 2012; Larmer & Mergendoller, 2012). In project-based learning, students are required to work together in teams to solve an authentic problem. Often the solutions are presented publically. This is not unlike the kinds of things expected of the modern worker. Specifically, employers call for employees who can not only solve problems but also identify them. They seek workers who can work with others effectively and use available resources, like technology to solve problems. They also

require creative thinkers who can research the innovations and apply them to dissimilar situations (Barell, 2010). These are the kinds of skills and abilities the research has shown project-based learning can address (Ravitz et al., 2012).

5.3 IMPLICATIONS

This study has shown that project-based learning implementations are not immune to challenges. "We are overloaded with so many different initiatives one thing cannot be done well," one respondent wrote. Comments like this one indicate a perception that initiatives, new ideas for how to teach students are heaped upon teachers. If that is the case, then knowing one initiative is grounded in history and theory might influence the degree to which that approach is implemented with fidelity.

Though project-based learning requires the teacher to play the role of facilitator rather than director of the instruction, this does not mean that all direct instruction is no longer of value. In some cases, it is necessary for the teacher to step outside of the role of facilitator and provide more direct instruction to specific skills or standards. In these times, the teacher is able to address the specific instructional needs dictated by state accountability requirements. The literature supports the need for this more direct instruction at times (Markham et al., 2003) and describes project-based learning as just as effective at increasing student achievement scores on standardized tests when those tests include more procedural types of questions (Boaler, 1998a; Strobel & van Barneveld, 2009; Thomas, 2000). For teachers who are concerned with meeting state requirements, there may be comfort in the knowledge that there is still a place for direct instruction at least until standardized tests include more problem solving in application

questions. In the event that standardized tests do begin to require more application of skills, project-based learning has been shown to be more effective than traditional approaches to teaching (Boaler, 1998a). It has also been shown to be effective at motivating students and the retention of long term knowledge (Boaler, 1998a; Strobel & van Barneveld, 2009; Thomas, 2000).

Despite these benefits, the teachers participating in this study indicated challenges that are influenced by or originate from outside pressures or organizational structures that are not conducive to the implementation of a non-traditional approach to teaching and learning. The study also revealed participant's difficulty in writing responses to the challenges they indicated they face when engaging in project-based learning experiences. The respondents also indicated an awareness of the 21st Century skills that are better addressed through project-based learning experiences than more traditional ways of teaching.

These results suggest a need for professional development that can address these findings. If many of the challenges teachers face originate from or are influenced by outside concerns, then school systems that wish to implement project-based learning would be smart to address these as much as possible. For instance, respondents to the study indicated that fitting the project-based learning into the school's schedule was a challenge. Schools should work with teachers on how to flex the bell schedule to allow for a more open approach that involves lengthy student collaboration research and presentation. Likewise, the study indicated that teachers are not always aware of how to respond to the challenges they indicated. If this is the case, then professional development is needed on how to design, for instance, a project-based learning experience, or how to fit in the standards or address state testing requirements. Finally, since the study revealed awareness that project-based learning does a better job teaching 21st Century

skills, then the importance of these skills should be made clear to the teachers. The professional development could focus on specific definitions of these skills and how to exercise them through the project-based learning experience. The results of the study hold promise in directing the professional development activities prior to implementation of a project-based learning initiative to best guide that implementation and ensure its success. Schools will know to train teachers on how to find time to plan and implement project-based learning, how to address the state standards, meet testing requirements, adjust the school's bell schedule, and design the project-based experience – all challenges revealed in the findings in this study.

The findings also raise some interesting questions as to the type of professional development needed to address the challenges identified in the study. For instance, does the number of teachers who mixed – about equally positive and negative about project-based learning as an approach – indicate that professional development must be differentiated to include basic knowledge project-based learning as an approach. Such professional development would be separate from professional development that addressed the needs of teachers who already perceived project-based learning positively.

The percentage of teachers who felt neutral about project-based learning also raises the question of the cause of their neutral perception. Is the perception of neutrality driven by outside influences, like the pressure to perform on state tests, for instance, or is it derived from some other concerns, like a perception that project-based learning is simply not any more of a viable approach than what they do now?

The findings showing that what challenged teachers the most came from outside influences may indicate that there is a tension between teacher freedom to direct their own instruction and the need to abide by school, district or state requirements. Are the results of the

study indications that the teachers feel particular pressure to meet outside requirements to the point where they feel less able – or they are less willing – to implement new approaches? Do these outside pressures outweigh the willingness to take the risks involved in implementing something new?

Selected literature on teacher agency support outside pressures can limit teachers' perception of how free they are to design and direct the instruction. Campbell (2012) for instance, reviews several articles that explore teacher agency and in one examining the impact of state reform on teacher agency in a Scottish high school, reveals the perception that state reforms are barriers to teachers' own sense of control and autonomy (p. 185). Similarly, Robinson (2012) explores the tensions caused between performance and accountability requirements and teachers' sense of professional agency. The article asks if these tensions de-professionalizing teachers to the role of mere technicians rather than professionals who "construct" and "negotiate" a new instructional approach (p. 231). Robinson (2012) suggests that, despite the pressures of adopting policy, through strong collegial relationships and collaboration, teachers can find ways to reshape requirements in order to meet them in their own way (p. 244). Literature like this suggest that despite the outside challenges teachers perceive they face when implementing project-based learning, teachers may still find ways to adapt practice in order to meet state requirements and implement project-based learning successfully. Riveros, Newton, & Burgess, (2012) write of the benefits of professional learning communities can improve teacher agency and increase student learning (p. 205). The article aligns to findings in this study that teachers did not perceive co-teaching and collaborating with other peers as challenges and suggests that a focus on collaboration and teacher ownership in the implementation process may be a way to address concerns over state accountability requirements and other external mandates.

The degree to which collaboration improves implementations suggests a target of further research as do the other questions raised by the results of the study.

5.4 RECOMMENDATIONS FOR FURTHER RESEARCH

This study explored the perceptions teachers had when implementing project-based learning. The results have the potential to guide the design of professional development experiences or implementations of project-based learning. What this study did not do, however, is study the efficacy of project-based learning compared to other kinds of teaching methods. Though there are studies that have been conducted to explore this, there are not many of them. More study is needed to see the benefits of the approach beyond teacher perceptions. Some of the difficulty with studying project-based learning is the varying definitions of the approach and the ways project-based learning is implemented (Markham, et al, 2003). Organizations like the Buck Institute for Education devote their focus to standardizing this definition. Other literature indicates common definitions of project-based learning (Bell, 2010; Bender, 2012; Larmer & Mergendoller, 2010; G. Solomon, 2003). As the approach is standardized by organizations that promote it and as literary and practical consensus is reached about how to define project-based learning, then it will become easier to study the effectiveness of the approach compared to other teaching methods.

Similarly, it would be interesting to more deeply study the role of 21st Century skills in project-based learning. Such a study would look beyond teachers' perceptions and explore the degree to which project-based learning really does teach 21st Century skills like the teachers in this study perceives it to do.

This study was limited by examining the perceptions of just one staff from one school. The questions in the instrument to collect data may also have been flawed and not gathered data exactly as defined. The question item on teachers' responses to the challenges of project-based learning, for instance, did not solely gather data on teachers' responses. Because of this, it would be beneficial for future research to gather similar data from other kinds of educational systems. Specifically, it would be interesting to study the perceptions of teachers who are implementing project-based learning in an urban, low socio-economic school. Likewise, it would be interesting to gather data on the perceptions of teachers who have implemented project-based learning for substantially longer periods of time than the participants in this study. It would be enlightening to compare data from this study with studies like those mentioned to determine if teachers' perceptions are any different than those gathered at one suburban school.

The selected literature on teacher agency gives rise to potential areas of further study. The exploration of the impact of external policy on implementations is one such area as well as the positive benefits of collaboration to alleviate the perceived challenge of meeting state requirements. The findings in this study suggest that teachers value collaboration. It is worthy of further study to explore the extent to which collaboration benefits successful implementations of project-based learning.

Student perceptions are another area ripe for further study of project-based learning. This study revealed a correlation between project-based learning and student motivation. Another study could collect data on how students feel about learning through project-based learning experiences. This could include a study of teachers' perceptions of student engagement in the approach since this study did not reveal any perceived concerns with student receptivity. A series of studies on the efficacy of project-based learning under more controlled conditions –

standard definition and implementation plan – and studies of 21st Century skills acquisition through project-based learning as well as studies on student perceptions, would provide a breath of research to determine the long-term viability of the approach.

5.5 CONCLUSION

Project-based learning is an instructional approach that has the potential to dramatically change teacher practice and student learning. The value of this approach rests in how well it changes practice and learning for the long-term betterment of student growth and learning. The degree to which it can prepare students for the kinds of challenges they will face in the future is a key indicator of the value of the approach.

The purpose of this study was to gather data on teachers' perceptions of project-based learning for the benefit of future implementations and teacher training. The study gave some indication of the challenges teachers face in a school relative to implementations. It also gave some indication of the value of 21st Century skills in the approach. Despite these insights, the study was limited in its ability to address the potential for project-based learning to be the answer for a modern American education. Regardless of this study's limited ability to come to such a conclusion, the study did indicate potential value of the approach.

Teachers generally like project-based learning, as this study showed. If teachers generally like something then they seem to hold value in it. When this is considered with the potential for project-based learning motivate students, it is easy to see the potential for project-based learning to change the ways teachers teach and students learn. This is especially important if the approach has the potential to prepare students with the skills necessary to be successful in

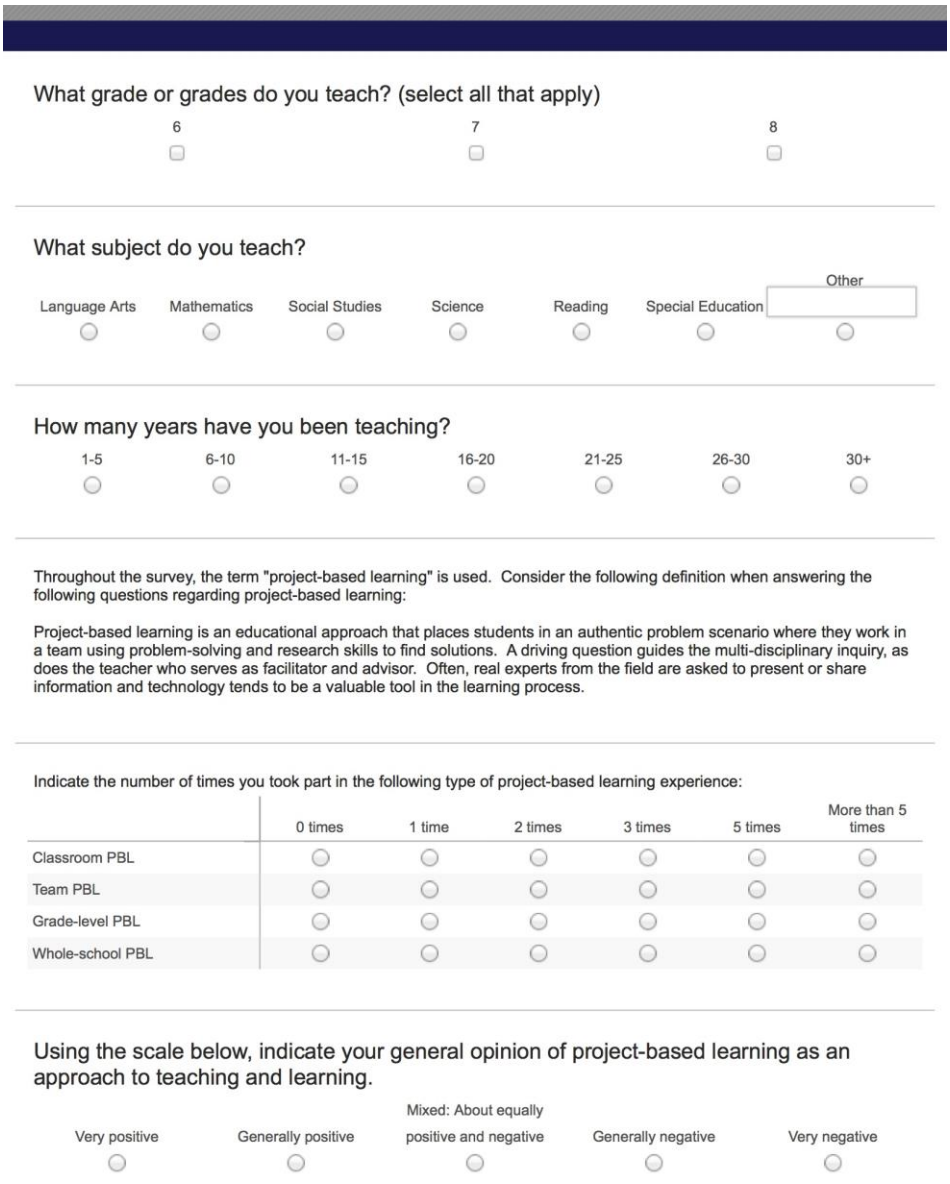
the modern work place. The educational community needs further research and practice at the school level to secure such an argument just yet. Until this time, an approach that taps into students' ability to work with others, solve complex, authentic problems and present findings, is bound to be an intriguing prospect for educational leaders interested in developing students who are ready for the problems and solutions of the future.

APPENDICES

The following appendixes include a copy of the questionnaire used to conduct the study (Appendix A) and the letter of permission to conduct the study (Appendix B).

APPENDIX A

Figure 1: Appendix A



What grade or grades do you teach? (select all that apply)

6 ☐ 7 ☐ 8 ☐

What subject do you teach?

Language Arts ○ Mathematics ○ Social Studies ○ Science ○ Reading ○ Special Education ○ Other ○

How many years have you been teaching?

1-5 ○ 6-10 ○ 11-15 ○ 16-20 ○ 21-25 ○ 26-30 ○ 30+ ○

Throughout the survey, the term "project-based learning" is used. Consider the following definition when answering the following questions regarding project-based learning:

Project-based learning is an educational approach that places students in an authentic problem scenario where they work in a team using problem-solving and research skills to find solutions. A driving question guides the multi-disciplinary inquiry, as does the teacher who serves as facilitator and advisor. Often, real experts from the field are asked to present or share information and technology tends to be a valuable tool in the learning process.

Indicate the number of times you took part in the following type of project-based learning experience:

	0 times	1 time	2 times	3 times	5 times	More than 5 times
Classroom PBL	○	○	○	○	○	○
Team PBL	○	○	○	○	○	○
Grade-level PBL	○	○	○	○	○	○
Whole-school PBL	○	○	○	○	○	○

Using the scale below, indicate your general opinion of project-based learning as an approach to teaching and learning.

Very positive ○ Generally positive ○ Mixed: About equally positive and negative ○ Generally negative ○ Very negative ○

What do you feel challenges you when implementing project-based learning experiences. Please rate each item from LEAST CHALLENGING (1) to MOST CHALLENGING (5).

	1	2	3	4	5	N/A	
Collaborating with other teachers	○	○	○	○	○	○	.
Co-teaching with other teachers	○	○	○	○	○	○	.
Shifting from directing the instruction to facilitating more group work.	○	○	○	○	○	○	.
Time to plan and implement	○	○	○	○	○	○	.
Creating the project (coming up with the idea)	○	○	○	○	○	○	.
Designing the project	○	○	○	○	○	○	.
Managing the student groups	○	○	○	○	○	○	.
Managing the entire project	○	○	○	○	○	○	.
Helping parents understand the project	○	○	○	○	○	○	.
Fitting all of the standards	○	○	○	○	○	○	.
Meeting all of the testing accountability requirements	○	○	○	○	○	○	.
Implementing the project within the school's schedule	○	○	○	○	○	○	.
Assessing the project to determine a grade	○	○	○	○	○	○	.

Please write of any thing else that challenges you when implementing project-based learning not listed above.

Of the challenges you indicated were MOST challenging, please provide a brief description of you addressed these challenges.

	1
Collaborating with other teachers:.	
Co-teaching with other teachers:.	
Shifting from directing the instruction to facilitating it:.	
Time to plan and implement:.	
Creating the project (coming up with the idea):.	

Designing the project:.

Managing the student groups:.

Managing the entire project:.

Helping parents understand the project:.

Fitting all of the State standards:.

Meeting all of the State testing accountability requirements:.

Implementing the project within the school's schedule:.

Assessing the project to determine a grade:.

Please describe any other ways you address challenges implementing project-based learning that were not mentioned above.

The questions below ask about the relationship between 21st Century skills and project-based learning.

Does project-based learning do a better job teaching 21st century skills? For each of the skills below, indicate to what extent you agree or disagree.

	Completely Agree	Generally Agree	About the same	Generally disagree	Completely disagree
Creativity and Innovation	○	○	○	○	○
Critical Thinking and Problem Solving	○	○	○	○	○
Communication and Collaboration	○	○	○	○	○
Information, Communications and Technology Literacy	○	○	○	○	○
Flexibility and Adaptability	○	○	○	○	○
Leadership and Responsibility	○	○	○	○	○
Initiative and Self-Direction	○	○	○	○	○

Social and Cross Cultural Skills	○	○	○	○	○
Productivity and Accountability	○	○	○	○	○

Thank you for completing the survey. Please share any other information you feel would be important to know regarding challenges facing teachers who implement project-based learning, how they respond to these challenges or the role of 21st Century skills in project-based learning.

>>

APPENDIX B

Figure 2: Appendix B

FOX CHAPEL AREA SCHOOL DISTRICT
"Excellence is not an act, but a habit." – Aristotle

Gene Freeman, Ed.D.
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August 29, 2014

Dr. David McCommons
Assistant Superintendent
Fox Chapel Area School District
611 Field Club Rd.
Pittsburgh, PA 15238

Dear Dr. McCommons,

I would like to request permission to conduct a study at Dorseyville Middle School, titled *The Challenges of Implementing Project-based Learning*. I am conducting the study to fulfill the requirements for my dissertation research.

The study has two purposes: 1) to examine what teachers feel challenges them the most when implementing Project-based Learning and, 2) to examine how teachers feel about the role of 21st Century skills in Project-based Learning. The study will collect data via on online survey to the Dorseyville Middle School staff. The survey should take no more than 10 minutes to complete and is completely confidential and voluntary and will be sanctioned by the University of Pittsburgh Institutional Review Board before being conducted.

The survey is attached to this letter for your review. After the study, I would be happy to share the results with you or any members of the district. If you have any questions or concerns about any of the questions or the study in general, please let me know. If you agree to allow me to conduct the pilot study, please sign in the space provided below.

Sincerely,

Matthew Harris

I grant permission for Matthew Harris to conduct the study *The Challenges of Implementing Project-based Learning.*

Signed _____ Date 9/29/14

We are an Equal Rights and Opportunity School District.

BIBLOGRAPHY

Alsop-Cotton, J. (2009a). Guided Inquiry: Learning in the 21st Century. *The Journal of Academic Librarianship*. Ann Arbor: Elsevier Inc.

Alsop-Cotton, J. (2009b). Guided Inquiry: Learning in the 21st Century. *The Journal of Academic Librarianship*. Ann Arbor: Elsevier Inc.

Anderson, J. (2010). Interdisciplinary Project-Based Learning Leads to Success. *Tech Directions*, *70*(4), 20–21.

Antić, Z., & Spasić, D. (2012). PROJECT-BASED LEARNING IN ENGLISH FOR MEDICINE. *Acta Medica Medianae*, *51*(2), 50–55.

Babbie, E. R. (2013). *The Practice of social research*. Belmont, CA: Wadsworth Cengage Learning.

Barell, J. (2003). *Developing More Curious Minds*. Alexandria: Association for Supervision & Curriculum Development (ASCD).

Barell, J. (2010). Problem-based learning: The foundation for 21st century skills. *21st Century Skills: Rethinking How Students Learn*, 174–199.

Barron, B. J. S., Schwartz, D. L., Vye, N. J., Moore, A., Petrosino, A., Zech, L., … Vanderbilt, T. C. and T. G. at. (1998). Doing with Understanding: Lessons from Research on Problem- and Project-Based Learning. *The Journal of the Learning Sciences*, *7*(3/4), 271–311.

Barton, P. (2001). The Elementary and Secondary Education Act and Standards-Based Reform. *Center on Education Policy*. *Feb*.

Bell, S. (2010). Project-Based Learning for the 21st Century: Skills for the Future. *The Clearing House*, *83*(2), 39–43.

Belland, B. R., French, B. F., & Ertmer, P. A. (2009). Validity and Problem-Based Learning Research: A Review of Instruments Used to Assess Intended Learning Outcomes. *Interdisciplinary Journal of Problem-Based Learning*, *3*(1), 5.

Bender, W. N. (2012). *Project-based learning: differentiating instruction for the 21st century*. Thousand Oaks, Calif: Corwin Press.

Blumenfeld, P., Soloway, E., Marx, R., Krajcik, J., Guzdial, M., & Palincsar, A. (1991). Motivating Project-Based Learning: Sustaining the Doing, Supporting the Learning. *Educational Psychologist*, *26*(3), 369–398.

Boaler, J. (1998a). Alternative approaches to teaching, learning and assessing mathematics. *Evaluation and Program Planning*, *21*(2), 129–141.

Boaler, J. (1998b). Open and closed mathematics: Student experiences and understanding. *Journal for Research in Mathematics Education*, *29*(1), 41.

Boaler, J. (1999). Mathematics for the moment, or the millennium? *Education Week*, *18*(29), 30.

Bodilly, S. J., Keltner, B., & Purnell, S. (1998). *LESSONS FROM NEW AMERICAN SCHOOLS ' SCALE-UP PHASE Prospects for Bringing Designs* (p. 159).

Boss, S. (2012). The challenge assessing of project-based learning: on the heels of Common Core State Standards, administrators begin assessing critical thinking and content mastery. *District Administration*, *48*(9), 46–52.

Bradford, M. (2005). Motivating Students through Project-Based Service Learning. *T.H.E. Journal*, *32*(6), 29.

Buck Institute for Education. (n.d.). Project Based Learning | BIE. Retrieved June 01, 2013, from http://www.bie.org/

Callison, D. (2006). Project-Based Learning. *School Library Media Activities Monthly*, *XXII*(5).

Campbell, E. (2012). Teacher Agency in Curriculum Contexts. *Curriculum Inquiry*, *42*(2), 183–190.

Chang, L.-C., & Lee, G. C. (2010). A team-teaching model for practicing project-based learning in high school: Collaboration between computer and subject teachers. *Computers & Education*, *55*(3), 961–969.

College Board. (n.d.-a). College Board Statement in Response to Release of NGA Center/CCSSO Common Core State Standards Initiative.

College Board. (n.d.-b). *Course & Exam Redesign*. New York, N.Y.

Colley, K. (2008). Project-Based Science Instruction: A Primer--An Introduction and Learning Cycle for Implementing Project-Based Science. *Science Teacher*, *75*(8), 23–28.

Common Core State Standards Initiative. (n.d.). Common Core State Standards Initiative | Home. Retrieved June 01, 2013, from http://www.corestandards.org/

Common Core State Standards Initiative. (2010). *Introduction to the Common Core State Standards* (p. 1).

Common Core State Standards Initiative | English Language Arts Standards | Introduction | Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language. (n.d.). Retrieved July 15, 2013, from http://www.corestandards.org/ELA-Literacy/introduction/students-who-are-college-and-career-ready-in-reading-writing-speaking-listening-language

Converse, J. M., & Presser, S. (1986). *Survey questions: handcrafting the standardized questionnaire* (Vol. no. 07–063). Beverly Hills, Calif: Sage.

Cook, C., Heath, F., & Thompson, R. L. (2000). A Meta-Analysis of Response Rates in Web- or Internet-Based Surveys. *Educational and Psychological Measurement*, *60*(6), 821–836.

Daunic, A., Stichter, J. P., Conroy, M. A., & Haydon, T. (2008). Classroom-Based Research in the Field of Emotional and Behavioral Disorders: Methodological Issues and Future Research Directions. *The Journal of Special Education*, *41*(4), 209–222.

David, J. L. (2008). Project-based learning. *EDUCATIONAL LEADERSHIP*, *65*(5), 80–82.

Dewey , J. (1938). *Experience and education*. New York: Macmillan.

Dewey, J. (1938). *Experience and education* (Vol. no. 10). New York, NY: The Macmillan company.

Drake, K., & Long, D. (2009). Rebecca's in the dark: A comparative study of problem-based learning and direct instruction/experiential learning in two 4th-grade classrooms. *Journal of Elementary Science Education*, *21*(1), 1–16.

Ebert Flattau, P., Bracken, J., Van Atta, R., Bandeh-Ahmadi, A., de la Cruz, R., & Sullivan, K. (2006). *The National Defense Education Act of 1958: Selected Outcomes*. Washington, D.C.

Elementary and Secondary Education Act of 1965. (2009). *Poverty and the Government in America: A Historical Encyclopedia*.

Flynn, P. (1995a). Global Competition and Education: Another Sputnik? *The Social Studies*, *86*(2), 53–55.

Flynn, P. (1995b). Global Competition and Education: Another Sputnik? *The Social Studies*, *86*(2), 53–55.

Foss, S. K., & Waters, W. J. C. (2007). *Destination dissertation: a traveler's guide to a done dissertation* (p. 368). Lanham: Rowman & Littlefield Publishers.

Fowler, F. J. (1995). *Improving survey questions: design and evaluation* (Vol. 38). Thousand Oaks: Sage Publications.

Friel, B. (2005). A NEW SPUTNIK MOMENT? *National Journal*, *37*(31), 2452.

Fullan, M. (1983). Evaluating Program Implementation: What Can Be Learned from Follow Through. *Curriculum Inquiry*, *13*(2), 215–227.

Fullan, M. G. (1990). Editorial: Beyond Implementation. *Curriculum Inquiry*, *20*(2), 137–140.

Fullan, M., & Pomfret, A. (1977). Research on Curriculum and Instruction Implementation. *Review of Educational Research*, *47*(2), 335–397.

Fuller, F. F. (1969). Concerns of Teachers: A Developmental Conceptualization. *American Educational Research Journal*, *6*(2), 207–226.

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.

Gentry, M. (2006). No Child Left Behind: "Neglecting Excellence." *Roeper Review*, *29*(1), 24–27.

George, A. A., Hall, G. E., Stiegelbauer, S. M., & Laboratory, S. E. D. (2006). *Measuring Implementation in Schools: The Stages of Concern Questionnaire*. Southwest Educational Development Laboratory.

Grant, M. M. (2011). Learning, Beliefs, and Products: Students' Perspectives with Project-based Learning. *Interdisciplinary Journal of Problem-Based Learning*, *5*(2), 6.

Gugliucci, M. R., & Weiner, A. (2013). Learning by living: life-altering medical education through nursing home-based experiential learning. *Gerontology & Geriatrics Education*, *34*(1), 60–77. doi:10.1080/02701960.2013.749254

Gunter, G. A. (2007). Building student data literacy: an essential critical-thinking skill for the 21st century. *Multimedia & Internet@Schools*, *14*(3), 24.

Gut, D. M. (2011). Integrating 21st Century Skills into the Curriculum. In *Bringing Schools into the 21st Century* (Vol. 13, pp. 137–157). Dordrecht: Springer Netherlands.

Hall, G. E., Wallace, R. C., & Dossett, W. F. (1973). *A Developmental Conceptualization of the Adoption Process Within Educational Institutions*. Research and Development Center for Teacher Education, University of Texas at Austin.

Hammerman, E. L. (2006). *8 essentials of inquiry-based science, K-8*. Thousand Oaks, Calif: Corwin Press.

Hatch, J. A. (2002). *Doing qualitative research in education settings*. Albany: State University of New York Press.

Hunkins, F. P., & Ornstein, A. C. (1989). Curriculum Innovation and Implementation. *Education and Urban Society*, *22*(1), 105–114.

International Centre for Educators' Learning Styles. (2014). John Dewey's Philosophy of Experience and Education. Retrieved from http://www.icels-educators-for-learning.ca/index.php?option=com_content&view=article&id=53&Itemid=68

Introduction to Survey Research | Qualtrics. (n.d.). Retrieved July 05, 2014, from http://www.qualtrics.com/university/researchsuite/research-resources/survey-basics/introduction-to-survey-research/

Johnson, F. (2011). Grading No Child Left Behind. *National Journal*. Washington: Atlantic Media, Inc.

Johnson, L., Adams, S., & Consortium, N. M. (2011). *Challenge Based Learning: The Report from the Implementation Project*. *New Media Consortium*. New Media Consortium.

Johnson, R. T., & Johnson, D. W. (1999). Making Cooperative Learning Work. *Theory into Practice*, *38*(2), 67–73.

Jr, C. E. F. (2010). A Sputnik Moment for U.S. Education. *Wall Street Journal*, p. A.21. New York, N.Y: Dow Jones & Company Inc.

Kim, M. J. (2011). Empowering Teachers to Find America's New Sputnik Moment. *U.S. News & World Report*, 1.

Kwok, P.-W. (2014). The role of context in teachers' concerns about the implementation of an innovative curriculum. *Teaching and Teacher Education*, *38*, 44–55.

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.

Larmer, J. (2009). *Project_Based_Learning_Starter_Kit* (First Edit., p. 138). Novato, California: Buck Institute for Education. Retrieved from bie.org

Larmer, J. (2013). Project Based Learning vs. Problem Based Learning vs. XBL | Blog | Project Based Learning | BIE. *bie.org*. Retrieved June 21, 2014, from http://bie.org/blog/project_based_learning_vs._problem_based_learning_vs._xbl

Larmer, J., & Mergendoller, J. R. (2010). 7 Essentials for Project-Based Learning. *Educational Leadership*, *68*(1), 34.

Larmer, J., & Mergendoller, J. R. (2012). Speaking of speaking.(Common Core state standards and project-based learning). *Educational Leadership*, *70*(4), 74.

Learning, C. F. O. R., & Development, P. (1969). Problem-based Learning. *Learning*, *1968*(4), 210–5.

Lefkowits, L., & Miller, K. (2006). Fulfilling the Promise of the Standards Movement. *The Phi Delta Kappan*, *87*(5), 403–407.

Leithwood, K. A., & Montgomery, D. J. (1980). Evaluating Program Implementation. *Evaluation Review*, *4*(2), 193–214.

Leland, C. H., & Kasten, W. C. (2002). Literacy Education for the 21st Century: It's Time To Close the Factory. *Reading and Writing Quarterly: Overcoming Learning Difficulties*, *18*(1), 5–15.

Lewis, A. C. (2002a). A horse caled NCLB. *Phi Delta Kappan*, *84*(3), 179.

Lewis, A. C. (2002b). Who's left behind? *The Education Digest*, *67*(7), 69.

Manning, M. M., Manning, G. L., & Long, R. (1994). *Theme immersion: inquiry-based curriculum in elementary and middle schools*. Portsmouth, N.H: Heinemann.

Mansfield, C. L. (n.d.). NASA - Apollo 11. Brian Dunbar. Retrieved from http://www.nasa.gov/mission_pages/apollo/missions/apollo11.html

Markham Larmer, John., Ravitz, Jason Louis., Buck Institute for Education., T. (2003). *Project based learning handbook : a guide to standards-focused project based learning for middle and high school teachers*. Novato, Calif.: Buck Institute for Education.

Markham, T. (2011). Project based learning: a bridge just far enough.(FEATURE ARTICLE). *Teacher Librarian*, *39*(2), 38.

Maxwell, N. L., Mergendoller, J. R., & Bellisimo, Y. (2005). Problem-Based Learning and High School Macroeconomics: A Comparative Study of Instructional Methods. *The Journal of Economic Education*, *36*(4), 315–331.

McLeod, S. (2009). Jean Piaget, *24*(1-2), 311–327.

Mergendoller, J. R., Maxwell, N. L., & Bellisimo, Y. (2006). The Effectiveness of Problem-Based Instruction: A Comparative Study of Instructional Methods and Student Characteristics. *Interdisciplinary Journal of Problem-Based Learning*, *1*(2).

Mertens, D. M. (2010). *Research and Evaluation in Education and Psychology: Integrating Diversity With Quantitative,Qualitative, and Mixed Methods*. SAGE Publications.

National Center for Educational Statistics. (n.d.). Commissioner's Remarks - NCES Statement on PISA 2012 - December 3, 2013. Retrieved September 04, 2014, from http://nces.ed.gov/whatsnew/commissioner/remarks2013/12_03_2013.asp

National Governors Association and The Council of Chief State School Officers and Achieve Inc. (2008). *Benchmarking for Success: Ensuring U.S. Students Receive a World-Class Education* (p. 52).

Neufeld, V. R., & Barrows, H. S. (1974). The "McMaster Philosophy": an approach to medical education. *Journal of Medical Education*, *49*(11), 1040.

Nowicki, R. (2006). No Child Left Behind-Dump It. *Journal of Progressive Human Services*, *17*(2), 1–3.

OECD, O. for E. C. and D. (2012). *Preparing Teachers and Developing School Leaders for the 21st Century: Lessons from Around the World* (p. 107). Washington: OECD Publishing.

Parntership for 21st Century Skills. (n.d.). Our Mission. Retrieved July 14, 2013, from http://www.p21.org/about-us/our-mission

Partnership for 21st Century Skills. (n.d.). The Partnership for 21st Century Skills. Retrieved July 14, 2013, from http://www.p21.org/

Partnership for 21st Century Skills. (2011). *Framework for 21st Century Learning* (pp. 1–2). Washington, D.C.

Pearlman, B. (2006). Twenty-first century learning in schools: A case study of New Technology High School in Napa, California. *New Directions for Youth Development*, *2006*(110).

Personalizing Learning in the 21st Century. (2010). GB: Network Continuum Education.

Piaget , Piaget, Jean,, J. (1973). *To understand is to invent: the future of education*. New York: Grossman Publishers.

Powell, A. (2007). How Sputnik changed U.S. education | Harvard Gazette. *Harvard Gazette*. Retrieved from http://news.harvard.edu/gazette/story/2007/10/how-sputnik-changed-u-s-education/

Quigley, D. (2010). *Project-based learning and student achievement*. ProQuest, UMI Dissertations Publishing.

Ravitz, J. (2009). Introduction : Summarizing Findings and Looking Ahead to a New Generation of PBL Research, *3*(1), 3–11.

Ravitz, J., Hixson, N., English, M., & Mergendoller, J. (2012). Using project based learning to teach 21 st century skills : Findings from a statewide initiative, 1–9.

Risinger, C. F. (2008). Teaching and Learning about Skills for the 21st Century Using the Internet. *Social Education*, *72*(7), 380.

Rivero, V. (2010). 21st-Century Learning in 2010: A Global Imperative. *MultiMedia & Internet@Schools*, *17*(5), 11.

Riveros, A., Newton, P., & Burgess, D. (2012). A situated account of teacher agency and learning: critical reflections on professional learning communities. *Canadian Journal of Education*, *35*(1), 202.

Roberts-Gray, C. (1985). Managing the implementation of innovations. *Evaluation and Program Planning*, *8*(3), 261–269. doi:10.1016/0149-7189(85)90048-5

Robinson, S. (2012). Constructing teacher agency in response to the constraints of education policy: adoption and adaptation. *Curriculum Journal*, *23*(2), 231.

Saavedra, A. R., & Opfer, V. D. (2012). Learning 21st-Century Skills Requires, 21st-Century Teaching. *Phi Delta Kappan*, *94*(2), 8–13.

Salpeter, J. (2003). 21st Century Skills: Will our students be prepared? *Tech & Learning*, *24*(3), 17.

Schleicher, A. (2011). The case for 21st century learning. *Organisation for Economic Cooperation and Development*. *The OECD Observer*, (282/283), 42.

Semeniuk, I. (2007). How Sputnik changed our world. *New Scientist*, *195*(2620), 42.

Shih, J.-L., Chuang, C.-W., & Hwang, G.-J. (2010). An Inquiry-Based Mobile Learning Approach to Enhancing Social Science Learning Effectiveness. *Educational Technology & Society*, *13*(4), 50–62.

Solomon, G. (2003). Project-based learning: A primer. *Tech & Learning*, *23*(6), 20.

Solomon, G. B. T.-T. & L. (2003). Project-based learning: a primer: when students are challenged to get to work solving real-life problems, the whole world becomes a classroom. Here we offer a guide for getting started. (Cover Story), *23*(6), 20+.

Stanley, T. (2012). *Project-based learning for gifted students: a handbook for the 21st-century classroom*. Waco, Tex: Prufrock Press Inc.

State Higher Education Executive Officers. (2009). *State Higher Education Executive Officers* (p. 1). Boulder, CO.

Strobel, J., & van Barneveld, A. (2009). When is PBL More Effective? A Meta-synthesis of Meta-analyses Comparing PBL to Conventional Classrooms. *Interdisciplinary Journal of Problem-Based Learning*, *3*(1).

Summers, E. J., & Dickinson, G. (2012). A Longitudinal Investigation of Project–based Instruction and Student Achievement in High School Social Studies. *Interdisciplinary Journal of Problem-Based Learning*, *6*(1), 6.

Telzrow, M. E., & Welch, R. (2007). SPUTNIK. *The New American*, *23*(20), 32.

Thomas, J. W. (2000). *A Review of Research on Project-based Learning* (p. 49). San Reafael, CA.

US Department of Education. (1983). *A Nation at Risk : The Imperative for Educational Reform*. Washington, D.C.

US Department of Education. (2008). *A Nation Accountable: 25 Years After A Nation At Risk*. *U.S. Department of Education*.

US Department of Education. (2009, September 21). Archived : Statement by U . S . Education Secretary Duncan on Dr ... Statement by U . S . Education Secretary Duncan on Draft College- and Career- Readiness Standards in English-Language Arts , Mathematics. Washington, D.C.

Vrakking, W. J. (1995). The implementation game. *Journal of Organizational Change Management*, *8*(3), 31–46.

Vygotskiĭ, L. S., & Cole, M. (1978). *Mind in society: the development of higher psychological processes*. Cambridge: Harvard University Press.

Walker, A., & Leary, H. (2009). A Problem Based Learning Meta Analysis : Differences Across Problem Types , Implementation Types , Disciplines , and Assessment Levels, *3*(1), 3–24.

Weinbaum, A., Gregory, L., Wilkie, A., Hirsch, L., Fancsali, C., & Academy for Educational Development New York, NY, I. (1996). *Expeditionary Learning Outward Bound. Summary Report*.

Wessel, C., & Spreckelsen, C. (2009). Continued Multidisciplinary Project-based Learning – Implementation in Health Informatics. *Methods of Information in Medicine*, *48*(6), 558–563.