

RUNNING HEAD: PBL: PERCEPTIONS AND STUDENT ACHIEVEMENT IMPACT

PROJECT-BASED LEARNING: STAKEHOLDERS' PERCEPTIONS AND
STUDENT ACHIEVEMENT IMPACT

A DISSERTATION
SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE
DOCTOR OF EDUCATION
BY
SHELLEY G. GIES
DISSERTATION ADVISOR: DR. MARILYNN QUICK

BALL STATE UNIVERSITY

MUNCIE, INDIANA

MAY 2017

SIGNATURE PAGE

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BALL STATE UNIVERSITY
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No one can do it alone. If there is one thing I have learned in my life, it is that we need each other. I have been blessed to share my life with my husband, Kristopher, whose encouragement never wavered. He believed in me even when I did not believe in myself. He encouraged me to continue my work when it would have been much easier to give up. Thank you for helping me follow my dreams.

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ABSTRACT

DISSERTATION TOPIC: Project-Based Learning: Stakeholders' Perceptions and Student Achievement Impact

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Proponents of Project-Based Learning (PBL) claim that students gain a deeper understanding of the concepts and standards, while building vital workplace skills. Claims are also made that PBL allows students to address community issues, explore careers, interact with adult mentors, use technology, and present their work to audiences beyond the classroom. PBL advocates believe that PBL motivates students who might otherwise find school boring or meaningless (Buck Institute for Education, 2011).

One purpose of this study was to examine the perceived differences between a PBL classroom and those of a more traditional classroom. Another purpose of this study was to discover which students, parents, and teachers chose PBL over the more traditional setting and why they made that choice. Student achievement results of both methodologies were examined, and stakeholders' perceptions surrounding PBL were collected, analyzed, and interpreted. The goal was to contribute participants' perspectives for the benefit of scholars, administration, teachers, parents, and students. The study also served to provide program evaluation data to the school's leaders to guide future decision-making regarding PBL in the school and district.

A mixed-method approach employing both quantitative and qualitative research methods was utilized in this study. The quantitative portion of this study focused on the analysis of student achievement data and a survey completed by students and parents. The survey provided information on those classroom features that were most and least valued by students and parents. Additionally, the survey provided a program review as the students and parents who had been involved in PBL provided their judgments about whether the program had met their expectations, compared to their traditional programming experiences. The analysis of the data suggested that there is no significant statistical difference between the two groups' results and there is no evidence to support PBL increased student achievement.

The qualitative part of this mixed-method research explored the participants' perspectives more deeply as it captured their goals, thoughts, and feelings surrounding both PBL and traditional educational approaches. With the use of interview processes, a deeper understanding of the perceptions of the participants was ascertained, which resulted in a richer output than just engaging in quantitative research alone. Preparation for the real world in which students compete for jobs was important to students and parents in both programs; however, perceptions varied about which type of programming led to this success. Educators agreed there were far more barriers than strengths to the implementation of PBL as the vision was embraced by few, had little staff buy-in and lacked quality training. Students and parents, who were in search of a different approach to learning, cared most about methodologies that honored student learning styles, embraced technology, and prepared students for the real world in working with people of different backgrounds and abilities.

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CHAPTER 1: INTRODUCTION

There are always those adventurers in education who are wanting to push the frontiers of what is possible and are driven by a passionate belief in what schooling should and could be like. It is such people who have always found ways to unlock the future for many youngsters who would otherwise spend their lives realizing only a fraction of their potential.

(Brighthouse, 2012, p. 3)

One of the fundamental issues facing educators is that education is turning into a collective effort (Duffy & Jonassen, 1992; Dufour, Dufour, Eaker, & Many, 2010; Wertsch, 1985). The expansion of networks and social media means that the group mind is evolving, and we will soon find ourselves trying to distinguish what an individual knows versus what the group knows. Project-based learning (PBL) involves the students going through an extended process of inquiry in response to a complex question, problem, or challenge. For PBL this means that teachers must be extremely proficient at facilitating teamwork and leading group problem solving toward excellence and high performance. The challenge of moving to a collaborative form of schooling and learning will involve everyone from educators to parents to students.

Statement of the Problem

Proponents of project-based learning (PBL) claim that students involved with its environment gain a deeper understanding of the concepts and standards, while building vital workplace skills and lifelong habits of learning. Claims are also made that PBL allows students to address community issues, explore careers, interact with adult mentors,

use technology, and present their work to audiences beyond the classroom. PBL advocates believe that it can motivate students who might otherwise find school boring or meaningless. PBL promises a shift in the culture of learning in a school (Buck Institute for Education, 2011; Edutopia, 2008; Hmelo-Silver, 2004; Moursund, 1999; Thomas & Mergendoller, 2000).

Purpose of the Study

One purpose of this study was to examine the perceived differences between a PBL classroom and those of a more traditional classroom. Another purpose of this study was to discover which students, parents, and teachers chose PBL over the more traditional setting and why they made that choice. Student achievement results of both methodologies were examined, and stakeholders' perceptions surrounding PBL were collected, analyzed, and interpreted. The goal was to contribute participants' perspectives for the benefit of scholars, administration, teachers, parents, and students. The study also serves to provide program evaluation data to the school's leaders to guide future decision-making regarding PBL in the school and district.

Research Questions

The following research questions guided this study.

1. In a suburban high school giving the students the choice to engage in PBL, what effect does PBL have on student achievement?
2. How do the perceptions of students and parents in the PBL setting compare to the perceptions of student and parents in the traditional setting?
3. What are the perceptions of teachers in a traditional setting, teachers in the PBL setting, and with administrators surrounding both learning models?

4. If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why?

Significance of the Study

There appeared to be a gap in the current research in the area of participants' perception surrounding PBL. The voices of students and parents had rarely been heard, and there was a need to examine the perceptions of students and parents (as well as teachers and administrators) to discover if they demonstrated changes in behavior and attitudes toward learning as a result of their involvement in PBL.

It was important to discover which students, parents, teachers, and administrators chose PBL over the more traditional setting and why they are made that choice. It was also important to study this issue as several schools in the Midwest are moving in the direction of organizing parts (or all) of their schools in formats that support and promote PBL. For educators, students, and parents to understand what is involved in this endeavor, we must study the issue by raising important questions to be answered through careful, intentional research.

I became interested in learning more about PBL to increase my knowledge base on models of instruction that will help our students excel. Assessment of Readiness for College and Careers (PARCC) and the Smarter Balanced Assessment Consortium (Smarter Balanced) are two examples of such assessments that claim to assess levels of student preparedness for the world in which they will live and compete for jobs. My interest in this topic peaked when I attended a public school board meeting in central Indiana where parents of higher achieving high school students were upset that their

student would be in a PBL classroom and would be required to work with students perceived to be of lower achievement.

Delimitations

This study included one school district with administrators, teachers, parents, and students who had the option of choosing PBL or traditional programming. Because the total number of participants was small, the results of this study were not fully generalizable.

Definitions

Project-based learning. To pinpoint the definition of PBL is a challenge that is clearly documented in the research. For the purposes of this study, simply stated, PBL is a model that organizes learning around projects. PBL is a process whereby students explore and learn content via authentic, problem-based projects essential to the curriculum. PBL places more emphasis on meaning and understanding than on reproducing surface level knowledge (Hattie, 2009, 2013) and is defined as an extended learning process that uses inquiry and challenge to stimulate the growth and mastery of skills (Markham, 2003). PBL also emphasizes a carefully planned assessment that incorporates formative feedback, using detailed rubrics and multiple measures of content and skills. PBL offers teachers the opportunity to teach, observe, and measure the growth of real world skills.

Edmodo is an electronic social learning platform for teachers, students, and parents. Using Edmodo, students and teachers can reach out to one another and connect by sharing ideas, problems, and tips.

FlexBook tools is an online platform for assembling, authoring, and distributing interactive, multi-modal educational content. Inside each book, entire chapters or bite-sized concepts can be rearranged, added, removed, and edited. FlexBooks can be shared for free with user-created groups in print, online, by email, or on social media platforms.

Summary

There are some in education who might feel that PBL is a perfect example of adventurous education and is far overdue in US schools. The purpose of this study was to examine the perceived differences between a PBL classroom and those of a more traditional classroom and discover which students, parents, and teachers chose PBL over the more traditional setting and why they made that choice. The purpose also was to examine student achievement data and provide program evaluation data to the school's leaders to guide future decision-making regarding PBL in the school and district. The goal was to contribute participants' perspectives for the benefit of scholars, administration, teachers, parents, and students.

CHAPTER 2: LITERATURE REVIEW

Proponents of PBL (Buck Institute for Education, 2011) claim that students involved with its environment gain a deeper understanding of the concepts and standards, while building vital workplace skills and lifelong habits of learning. Claims are also made by the Buck Institute that PBL allows students to address community issues, explore careers, interact with adult mentors, use technology, and present their work to audiences beyond the classroom. PBL advocates believe that it can motivate students who might otherwise find school boring or meaningless (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Hmelo-Silver, 2004; Patton, 2012).

The purpose of this research review was to provide a comprehensive analysis that examined PBL, most of which took place in the past 20 years. The argument can be made that evidence supporting PBL can be traced back to the work of John Dewey's book, *Experience and Education*, which was written in 1938. The majority of the research that I found, however, was conducted in the 1990s. Recent interest in PBL has been propelled due to the accountability era and the reaction to skill-based learning, the increasing capabilities of technology, and the onset of the new college and career readiness measures of student achievement assessments that went into effect in 2015 in many states (Buck Institute, 2012; Smarter Balance, 2012).

This review includes the following topics: a definition of PBL, background and theoretical context of PBL, effectiveness of PBL, challenges associated with enacting PBL, the relationship between PBL and 21st century issues, conclusions made from the research, and directions for further PBL research.

Defining Project-Based Learning

Simply stated, PBL is a model that organizes learning around projects.

Understanding PBL begins with realizing that PBL and doing projects are not the same. Proponents of PBL claim that the method is more than hands-on learning activities and a far more evolved method of instruction. In traditional teaching and learning, projects were designed as a culminating activity to a lecture or a break from lecture-style teaching. Teachers planned projects at the end of the semester as a reward or an opportunity for students to finally demonstrate what they had learned during the year. Also, most projects emphasized activities over assessment, putting projects in conflict with the era of accountability catapulted forward by NCLB in 2000 (Bell, 2010). Those who advocate for PBL believe that the method involves an innovative approach to learning that has been readily employed that teaches a multitude of strategies critical for success in the 21st century (Edutopia, 2008). Students drive their own learning through inquiry, as well as work collaboratively to research and create projects that reflect their knowledge. From gleaning new, viable technology skills, to becoming proficient communicators and advanced problem solvers, students benefit from this approach to instruction (Bell 2010).

According to the definitions found in PBL handbooks for teachers, projects are complex tasks based on challenging questions or problems that involve students in design, problem-solving, decision making, or investigative activities; opportunities for students to work relatively autonomously over extended periods of time; and realistic products or presentations (Bullard & Bullock, 2006; Jones, Rasmussen, & Moffitt, 1997; Thomas, Mergendoller, & Michaelson, 1999). Other defining features found in the

literature include authentic content, authentic assessment, teacher facilitation, explicit educational goals, cooperative learning, reflection, and incorporation of adult skills (Bullard & Bullock, 2006; Diehl, Grobe, Lopez, & Cabral, 1999; Grant, 2002; Moursund, 1999).

Definitions of project-based learning include features relating to the use of a driving question, the idea of inquiry, and the use of technology-based tools (Bullard et al. 2006; David, 2008; Krajcik et al., 1994; Marx, Blumenfeld, Krajcik, Blunk, Crawford, Kelly, & Meyer, 1994; & Melin, Axelsson, & Wedlund, 2009). “Expeditionary Learning” adds features of comprehensive school improvement, community service, and multidisciplinary themes that allow in-depth investigation of a topic the learner thinks is worthy of learning (Boss & Krass, 2007; Marx et al. 1994; Mednick & Wainwright, 1999).

Gijbels, Dochy, Van den Bossche, & Segers (2005) outlined six characteristics of problem-based learning that were core to its success. Those characteristics are:

- Learning is student-centered.
- Learning occurs in small groups.
- A facilitator is present at all times.
- Authentic problems are presented at the beginning of the learning experience.
- The problems encountered are used as tools to achieve the required knowledge and problem solving skills used to solve the problem.
- New information is acquired via self-directed learning.

The lack of a universally accepted model or theory of PBL has resulted in a vast variety of PBL research with difficulty identifying a distinct body of research on PBL

(David, 2008). This diversity in definitions presents some complications for an understanding what PBL entails. As Tretten and Zachariou (1997) reported in their observation study on PBL in multiple classrooms, the variety of practices under the banner of PBL made it difficult to assess what is and what is not PBL. Researchers have posed suggestions to determine what particular features must be present or absent in order for an instructional activity to be considered PBL.

Various authors mentioned authenticity, constructivism, and the importance of learning new basic skills in attempting to describe the difference between PBL and prior models that involved projects (Diehl et al., 1999). There were also similarities between models referred to as PBL and models referred to with other labels, such as “intentional learning” (Scardamalia & Bereiter, 1991), “design experiments,” (Brown, 1992) and “problem-solving teaching” (Gallagher, Stepien, & Rosenthal, 1992; Hattie, 2009; Hembree, 1992; Mellinger, 1991), “problem-based learning” (Dochy, Segers, Van den Bossche, & Gijbels, 2003; Gijbels et al., 2005; and “inquiry-based learning” (Bangert-Drowns, & Blanker, 1990; Bredderman, 1983; Hattie, 2009; Shymakasy, Hedges, & Woodworth, 1990). Taking this into account, I have been more inclusive than exclusive in my definition of PBL for the purposes of this study.

Hmelo-Silver (2004) described problem-based learning as a process whereby students work collaboratively to “identify what they need to learn in order to solve a problem that does not have a single correct answer” (p. 235). Teachers facilitate the process as “students engage in self-directed learning (SDL) and then apply their new knowledge to the problem and reflect on what they learned and the effectiveness of the strategies employed” to solve the problem (Hmelo-Silver, 2004, p. 235). Similarly,

Thomas (2000) and Bullard and Bullock (2006) described project-based learning as a process whereby students explore and learn content via authentic, problem-based projects essential to the curriculum. PBL places more emphasis on meaning and understanding than on reproducing surface level knowledge (Hattie, 2009) and can be defined as an extended learning process that uses inquiry and challenge to stimulate the growth and mastery of skills (Markham, 2003). PBL also emphasizes a carefully planned assessment that incorporates formative feedback, using detailed rubrics and multiple measures of content and skills. PBL offers teachers the opportunity to teach, observe, and measure the growth of real world skills.

What Must a Project Include in Order to be Considered an Example of PBL?

The five criteria used for the purposes of this study, which are frequently cited in the literature, are centrality, driving questions, constructive investigations, autonomy, and real-world application (Barron, Schwartz, Vye, Moore, Petrosino, Zech, Bransford; Cognition and Technology Group at Vanderbilt, 1998; Bell, 2010). The next five sections describe each criteria more in-depth.

PBL Projects are Central, not Peripheral to the Curriculum

Projects are the curriculum in a PBL environment. The project is the central teaching strategy; students encounter and learn the central concepts of the discipline through the project. There are instances where project work follows traditional instruction in such a way that the project serves to provide illustrations, examples, additional practice, or practical applications for material taught. These projects, however, are not considered to be instances of PBL, according to this criterion. Another criterion around PBL is the idea of centrality, which means that projects in which students learn

things that are outside the curriculum or what educators call enrichment projects are also not examples of PBL. Students must practice and demonstrate the exact skills necessary in life requiring self-starting and self-managing. PBL refocuses education on the student, not the curriculum, which is a shift that is mandated by the global world, which rewards assets such as drive, passion, creativity, empathy, and resiliency (Markham, 2003; Krajcik, 2008).

PBL Projects Focus on Questions or Problems that Drive Students to Encounter the Central Concepts and Principles of a Content Area

The definition of the project must “be crafted in order to make a connection between activities and the underlying conceptual knowledge that one might hope to foster.” (Barron et al., 1998, p. 274; & Bullard & Bullock, 2006). This is usually done with a driving question. PBL projects may be built around thematic units or the intersection of topics from two or more disciplines, but that is not sufficient to define a project. The questions that students pursue, as well as the activities, products, and performances that occupy their time, must be “orchestrated in the service of an important intellectual purpose” (Blumenfeld et al., 1991, p. 381).

Projects Involve Students in a Constructive Investigation

An investigation is a goal-directed process that involves inquiry, knowledge building, and resolution. Investigations may be design, decision-making, problem-finding, problem-solving, discovery, or model-building processes. However, in order to be considered as a PBL project, the central activities of the project must involve the transformation and construction of new understanding and new ideas and create situations that can be authentic as in a real-life scenario (Bereiter & Scardamalia, 1999;

Kantrov & Hergert, 2011; Melin et al., 2009). Bell's (2010) work on PBL illustrated that children are constructing knowledge and building upon their background knowledge.

This approach is built upon the premise that children retain more information when they learn by doing. Dewey (1938) proposed that learning by doing had great benefit in shaping students' learning.

If the central activities of the project represent no difficulty to the student or can be carried out with the application of already-learned information or skills, the project is an exercise or practice, not a PBL project. This criterion means that straightforward service projects such as cleaning an area in the community or planting a garden are projects, but may not be PBL projects (Bereiter & Scardamalia, 1999).

Projects are Student-Driven

PBL projects are not teacher-led, scripted, or packaged. Laboratory exercises and instructional booklets are not examples of PBL, even if they are problem-focused and central to the curriculum. PBL projects do not end up at a predetermined outcome or take predetermined paths. PBL projects incorporate a good deal more student autonomy, choice, unsupervised work time, and responsibility than traditional instruction and traditional projects (Bereiter & Scardamalia, 1999).

The PBL approach has been implemented as early as preschool using the Reggio Emilia approach, which is a project-based learning approach that began in northern Italy. It is a child-centered approach where the children are encouraged to pursue their natural curiosity and discovery through experiences is carefully documented. Teachers guide students and are resources to students throughout their studies and students learn through

collaboration while employing critical thinking skills as they engage in projects (Bell, 2010).

Projects are Realistic, Not School-Like

Projects embrace characteristics that provide authenticity to students. These characteristics can include the topic, the tasks, the roles that students play, the context within which the work of the project is carried out, the collaborators who work with students on the project, the products that are created, the audience for the project's products, or the criteria by which the products or performances are judged. PBL incorporates real-life challenges where the focus is on authentic problems or questions and where solutions have the potential to be implemented (Bereiter & Scardamalia, 1999).

Thus, this review covers research and research-related articles on “project-based learning,” “problem-based learning,” “expeditionary learning,” and “project-based instruction” that conform to the criteria above. The review is focused, primarily, on published research conducted at the elementary and secondary levels. To do this, the next section of the review focuses on the theoretical context of PBL.

Background and Theoretical Context

The theoretical framework from which PBL is based is constructivism learning theory. Constructivism learning theory is a philosophy, which enhances students' logical and conceptual growth; argues that people produce knowledge and find meaning based upon their experiences; and can be described as a theory that deals with the way people create meaning of the world through different types of filters (Duffy & Jonassen, 1992; Grant, 2002; Wertsch, 1985; Rosenfeld, 2006).

The approach is based in part on the work of the American educator and philosopher John Dewey, who maintained that education is the reconstruction of experience (Dewey, 1916). Dewey, along with his wife and several teachers, developed the approach over a period of seven years (1896 to 1903) at his laboratory school at the University of Chicago, which challenged the view current at the time that knowledge was a fixed notion of truth waiting to be discovered. Learning had been viewed as a possession as a matter of class that was a necessary and practical result of social standing. For Dewey (1938), “knowledge is not absolute, immutable, and eternal, but rather relative to the developmental interaction of man with his world as problems arise to present themselves for solution” (p. viii). Dewey’s notions of learning grew out of the basic tenets of the newly evolved pragmatic theory of knowledge. When Dewey moved to Columbia University, his colleague William Kilpatrick popularized the approach as the Project Method (Kilpatrick, 1922).

Von Glasersfeld (1989) described constructivism as, “a theory of knowledge with roots in philosophy, psychology, and cybernetics” (p. 162). The student is required to act upon the environment to both acquire and test new knowledge. Constructivist learning theory advocates a learning process that allows a student to experience an environment first-hand, thereby, giving the student reliable and trust-worthy, constructed, knowledge that is guided by someone who has a higher ability level than the learner, connecting to Lev Vygotsky’s More Knowledgeable Other (Vygotsky, 1978). Furthermore, social interaction plays a fundamental role in the process of learning and the zone of proximal development, which is the distance between a student’s ability to perform a task under

guidance and the student's ability to solve the problem independently. In other words, the zone of proximal development is where the learning occurs.

Learners with different skills and backgrounds should collaborate in tasks and discussions to arrive at a shared understanding of the truth in a specific field and students should play an active role in learning. Learning should become a reciprocal experience for the students and the teachers (Duffy & Jonassen, 1992; Vygotsky, 1978; Wertsch, 1985).

Typically speaking, schooling in the United States had been set up as an individual journey with tracking of students by ability through upper grades in the K-12 system. Many schools have traditionally held a transmission model in which a teacher transmits information to students in which basic skills and facts are taught through direct instruction. In this approach, knowledge is transferred from the expert to the novice, primarily through lecture or print (Brooks & Brooks, 1993; & Bullard & Bullock, 2006).

The literature suggested that two key concepts within the constructivism learning theory are assimilation and accommodation. Assimilating enables a person to develop new outlooks and alter their original perceptions. Accordingly, the person may begin to incorporate new experiences into the old experiences. Accommodation, on the other hand, is reframing new experiences into the mental ability already present. Students conceive a way in which the world operates and when things do not operate within that context, they must accommodate.

Dewey professed that one engages inquiry as a problem solving and a communal process. Inquiry is demanded by what he called an "incomplete" or "problematic" situation, that is, one in which something must be done. The goal of inquiry is not simply

a change in the beliefs of the inquirers but the resolution of the problematic situation, in what Dewey called a “consummatory” course of action or state of affairs. The modern natural sciences, he argued, have been progressive and cumulative, giving us greater and greater control of the natural world (Dewey, 1910, 1916; Stanford Encyclopedia of Philosophy, 2005).

Knowing this information makes the role of educators important within the constructivism learning theory. Instead of giving a lecture, the teachers in this theory function as facilitators whose role is to aid the student when it comes to their own understanding. Focus is taken from the teacher and put upon the student and their learning. The resources and lesson plans for this learning theory take a very different approach than those of traditional learning. Instead of telling, the teacher must begin asking questions as they continually remain in conversation with the students, thus creating the learning experience that is open to new directions depending upon the needs of the student as the learning progresses.

Cognitive constructivism is based on the work of Swiss developmental psychologist Jean Piaget. Piaget’s theory proposed that humans cannot be given information that they immediately understand and use, but they must construct their own knowledge through experiences (Fischer, 1980). Cognitive research is cited in support of classroom research and development activities in PBL. This research can be divided into studies on motivation, expertise, contextual factors, and technology. Research on motivation includes research on students’ goal orientation and on the effect of different classroom reward systems. All things being equal, students who possess a motivational orientation that focuses on learning and mastery of the subject matter are more apt to

exhibit sustained engagement with schoolwork than students whose orientation is to merely perform satisfactorily or complete assigned work (Ames, 1992). PBL designs, because of their emphasis on student autonomy, collaborative learning, and assessments based on authentic performances, are seen to maximize students' orientation toward learning and mastery. Additionally, project-based learning designers have built in additional features such as variety, challenge, student choice, and non-school-like problems in order to promote students' interest and perceived value (Blumenfeld et al., 1991).

The way to insure that children become proficient at inquiry and problem solving is to simulate the conditions under which experts master subject matter and become proficient at conducting investigations (Blumenfeld et al., 1991). This has also led to recommendations for shifting the major portion of instruction in schools from teacher-directed, teacher-assigned work, to student-initiated, goal-driven, independent, intentional learning models with an emphasis on knowledge building (Bereiter & Scardamalia, 1987; Scardamalia & Bereiter, 1991).

PBL embraces the ideas of scaffolding instruction through the introduction of varieties of strategies intended to help students become proficient at conducting inquiry activities.

The master-apprentice relationship is used as an analogy for the teaching-learning situation . . . like masters, teachers should scaffold instruction by breaking down tasks; use modeling, prompting, and coaching to teach strategies for thinking and problem solving; and gradually release responsibility to the learner. (Blumenfeld et al., 1991, p 387)

The influence of contextual factors on cognition has also provoked a good deal of research and has had an influence on the authenticity and autonomy elements of project-based learning. According to Brown, Collins, and Duguid's (1989) research on situated cognition, learning is maximized if the context for learning resembles the real-life context in which the material will be used; learning is minimized if the context in which learning occurs is dissimilar to the context in which the learning will be used.

Additionally, research on contextual factors has led to the recommendation that learning that occurs in the context of problem solving is more likely to be retained and applied. Such learning is also seen as being more flexible than the passive knowledge that is acquired as a result of more traditional teaching methods (Boaler, 1998; Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990).

Finally, research on the application of technology to learning and instruction has led to an interest in using technology as a cognitive tool, especially in the incorporation into PBL as it relates to 21st century skills. In addition, technology has, among its benefits, the value of making the knowledge construction process explicit, thereby helping learners to become aware of that process (Brown & Campione, 1996). In their work, Krajick et al. (1994) stated that

using technology in project-based science makes the environment more authentic to students, because the computer provides access to data and information, expands interaction and collaboration with others via networks, promotes laboratory investigation, and emulates tools experts use to produce artifacts. (p. 542)

Constructivist thought raises serious and significant issues as to how to best educate students. There are many ways of making judgments about the effectiveness of PBL and the following section addresses this topic.

Effectiveness of Project-Based Learning

Most research indicates that PBL has a positive effect on student content knowledge and the development of skills such as critical thinking, problem solving, and collaboration; PBL benefits students by increasing their motivation and engagement (Railsback, (2002). The findings suggest that when fully realized PBL could improve student learning (Brush & Saye, 2008; Brunt, & Worsley, 1998; David, 2008; Krajcik, et al., 1998; Mergendoller, J. R., Marx, R. W., Blumenfeld, Krajcik, Blunk, Crawford, Kelley, & Meyer, 1994; Toolin, 2004; Wilhelm, Walters & Sherrod, 2008).

The following research was conducted in a variety of settings and discusses academic achievement on standardized tests. Research also discusses independent measures, data on gains in specific skills taught as demonstrated through the use of student performance tasks, and studies that relied on qualitative measures such as survey and participant self-report to evaluate the effectiveness of PBL.

Achievement on Standardized Tests

Research conducted in expeditionary learning schools (EL) and Co-NECT schools help to illustrate student achievement on standardized tests. Co-NECT, like EL, is a comprehensive, whole-school reform effort that placed strong emphasis on project-based learning, interdisciplinary studies, and real-world applications of academic content and community service. Co-NECT schools are also characterized as having a central emphasis on technology (Becker, Wong, & Ravitz, 1999). A study conducted by

University of Memphis researchers (Ross, Sanders, Stringfield, Wang, & Wright, 1999) compared Co-NECT schools to control schools in Memphis on Tennessee's Value-Added Assessment System. According to this report, Co-NECT schools gained almost 26% more than the control schools over the two-year period 1996-1998 and showed strong achievement gains in all subject matter areas. Comparable gains were reported for Co-NECT schools compared to district averages in a separate independent evaluation of Co-NECT schools in Cincinnati for the period 1995-1999 (Cincinnati Public Schools, 1999).

Expeditionary Learning Outward Bound publications reported that nine of 10 schools that implemented expeditionary learning (EL) in 1993 demonstrated improvement in students' test scores on standardized tests of academic achievement. According to a study conducted by the RAND corporation (Mednick & Wainwright, 1997), EL was the most successful program of the six new American school designs implemented in 1993 and cited that three elementary school in Iowa showed gains on the Iowa Test of Basic Skills from well below average as compared to the district average to well above the district average. After four years of EL implementation, students from the three Dubuque EL schools scored above the district average in almost every area (Thomas, 2000).

Elementary, middle, and high schools in Iowa, Massachusetts, Ohio, Tennessee, Maine, Colorado, Massachusetts and New York implemented the EL program in 1995-1997. For example, in Boston during this time, eighth-grade students at an inner-city EL school exhibited the second highest scores in the district on the Stanford 9 Open-Ended Reading Assessment. An EL elementary school serving 59% Hispanic and 27% African American students in the same district ranked 11th in math and 17th in reading out of 76

elementary schools on the same test (Mednick & Wainwright, 1997).

Similarly, in Portland, Maine, an EL middle school showed increases for the school year 1995-1996 in all six curriculum areas assessed with the Maine Educational Assessment battery. The improvement scores were of a magnitude three to 10 times larger (a 59 point increase, on the average) than that of the state as a whole (average gain of 15 points). Moreover, these improvement scores occurred at a time when the percentage of limited English speaking students increased in this EL middle school from 6% to 22% and these gains did not level out but increased an average of 25 additional points the following year (Mednick & Wainwright, 1997).

An additional study of EL schools conducted by the Academy for Educational Development (AED) demonstrated additional effects of EL implementation results from classroom observation, teacher interviews, and analyses of teacher reports in 10 EL schools revealed that EL schools influenced school climate and student motivation. According to this report, the EL experience increased participating teachers' beliefs in their ability to teach students of different ability levels, conduct assessments, and use parents and outside experts in the classroom, as well as their confidence in themselves as teachers and learners. Additionally, the AED report found attendance to be high in all EL schools, with an average attendance rate across all schools of over 90% (Mednick & Wainwright, 1997). It should be noted the findings above are from ELOB and Co-NECT publications and, therefore, could be interpreted in favor of PBL.

Problem Solving Abilities

Problem-Based Learning Model of PBL has been cited as the reason for increased student gains in problem-solving abilities. Faculty of the Illinois Mathematics and

Science Academy and the Chicago Academy of Science and studies by Stepien, Gallagher, and Workman (1995) have collaborated on studies examining the effect of a high-school version of the problem-based learning model on students' academic achievement and problem-solving skills. Results from this study focused on performance on a problem-solving test given as both a pretest and posttest. Gains between the pretest and posttest for the 78 students in the experimental group were compared to those for a matched comparison group that did not participate in the problem-based learning course. Of the six steps evaluated inclusion of problem finding showed the largest gain. Experimental students demonstrated equivalent or better knowledge of subject content as compared to a control class that studied the same period of history, but did not engage in problem solving.

Authentic Student Performance Measures

The effectiveness of PBL can be evaluated by looking at the performance of program participants (Doppelt, 2009; Edutopia, 2001; Ljung & Blackwell, 1996) described Project OMEGA, a program for at-risk teens that combines traditional instruction with problem-based learning part of that constitutes a school-within-a-school. Participants in the program all passed their English, U.S. history, and mathematics courses in the year following exposure to the program. Shepherd (1998) reported that PBL could have a positive effect on students' acquisition of critical thinking skills. The study found an increase on the part of the experimental group, as compared to the control students, on a test of critical thinking skills (The Cornell Critical Thinking Test). Additionally, experimental students reported increased confidence and learning, as a result of the nine-week project, on a self-report measure given after the program. A

study of a five-year evaluation reported by Penuel and Means (2000) incorporated a combination of real-world, student-directed projects with project-specific performance tasks and more general ability measures. Several researchers have found significant links between increased problem-solving skills and higher basic performance skills in math and science (Curbelo, 1984; Hembree, 1992; Marcucci, 1980).

Understanding of Subject Matter

Hattie (2009) synthesized several research projects involving inquiry-based teaching and problem-based learning. His work revealed that inquiry methods have often been studied in the context of science education. Bredderman (1983) reported $d = 0.35$ average effect size when teaching science using inquiry based methods. This study suggested that the effect size on science process skills ($d = 0.52$) was greater than the effect size on science recall of content ($d = 0.16$). These programs differed from science programs that used textbooks and focused on programs that utilized laboratory activities that decreased teacher-led discussions (Hattie, 2009). Other researchers also reported greater effects of inquiry teaching on process ($d = 0.27$) than content ($d = 0.30$). Effects were the greatest in elementary levels and decreased as these students progressed through high school.

Longitudinal studies of secondary schools produced results that suggest gains in students' understanding of the specific subject matter for those students involved in PBL methods of instruction over traditional schools. Boaler (1997, 1998, 2002a) described a longitudinal study of mathematics instruction conducted that employed a closely matched control population. Pre- and post-measures were included, and the study lasted for three years, thus allowing for multiple measures of growth using a variety of instruments,

throughout the study, to assess students' capabilities, achievement, and attitudes. Mathematics, in the traditional schools, was taught using whole class instruction, textbooks, tracking, and the frequent use of tests. At a PBL school, students worked on open-ended projects in heterogeneous groups. Students in the two schools were considered to be comparable in demographics and ability. Results from a national, standardized test of mathematics administered at the beginning of the study revealed no significant differences between the scores of students enrolled in the traditional school and those of students enrolled in the project-based school. At the traditional school, students' responses to the textbook-based teaching were, according to Boaler, consistent and fairly unanimous and the majority of students reported that they found the work boring and tedious. Additionally, the students regarded mathematics as a rule-bound subject and thought that mathematical success rested on being able to remember and use rules. In contrast, students at the project-based school regarded mathematics as a dynamic, flexible subject that involved exploration and thought (Boaler, 1997, 2002b). Not only were students at the traditional school unable to use their knowledge to solve problems, but also according to Boaler, "Students taught with a more traditional, formal, didactic model developed an inert knowledge that they claimed was of no use to them in the real world." (Boaler, 1998, p. 58). In contrast, "Students taught with a more progressive, open, project-based model developed more flexible and useful forms of knowledge and were able to use this knowledge in a range of settings" (Boaler, 1998, p. 58). After three years, students in the PBL school outperformed the traditional school students in mathematics skills as well as conceptual and applied knowledge. In fact, in the PBL school, three times as many students passed the national exam (Boaler, 2002a).

Understanding Specific Skills

Laboratory Studies of Project-Based Learning Effectiveness, the Cognition and Technology Group at Vanderbilt University (1992) and Barron et al. (1998) reported gains in understanding in specific skills and strategies in content areas for fifth grade students who were involved in PBL. Four PBL design principles were implemented: (a) learning goals were clearly defined, (b) scaffolds such as specific teaching tools were provided, (c) multiple opportunities for formative self-assessment and revision were ensured, and (d) social structures that promote participation and a sense of urgency were developed.

Bangery-Dtowns and Bankert (1990) found that inquiry-based instruction can foster critical thinking and has been shown to produce transferable critical thinking skill as well as improved achievement. Research findings show positive effects on student learning as gains were experienced in basic math concepts, word problems, planning capabilities, attitudes, and teacher feedback (Hattie, 2009). Students exposed to the problems showed positive gains in all areas compared to untreated control students. Also, pretest-posttest comparisons revealed that students in all ability levels showed gains in design proficiency and made gains in their ability to answer traditional test items covering scale, volume, perimeter, area, and other geometry concepts (Barron et al, 1998).

Through the use of Torrance tests of Creative Thinking, Mellinger (1991) examined studies involving cognitive flexibility in problem solving. The effect sizes were high on verbal flexibility ($d = 0.81$) for students in the treatment group.

Qualitative Measures

One of the ways to assess the effectiveness of an instructional treatment is to ask participants what they perceived to be its benefits or effects. Questionnaires and interviews are simple to administer and, sometimes, self-report measures are the only reasonable way to measure changes in dispositions, attitudes, and social skills. However, self-report measures are not measures of what happened, but of what participants perceive happened.

Studies in which self-reported data were used as a measure of project effectiveness included Bartscher, Gould, and Nutter, 1995; Boaler, 2002b; Peck, Peck, Sentz and Zasa, 1998; Tretten and Zachariou, 1995. PBL has resulted in high levels of student engagement (Belland, Ertmer, & Simons, 2006; Beringer, 2007; Brush & Saye, 2008; Clark, 2006; Grant, 2002; A. Patton, 2012; Ravitz, Hixson, English & Mergendoller, 2012; Stepien, & Gallagher, 1993; Walker, & Leary, 2008;). Students agreed that projects helped motivate them, and indicated increased interest in the topics involved. The authors reported that students, working both individually and cooperatively, felt empowered when they used effective work habits and apply critical thinking to solve problems by finding or creating solutions in relevant projects. Throughout this process, students are learning new knowledge, skills and positive attitudes. Results also revealed that students perceived that they learned literacy skills from participation in the course such as using multiple texts, revisiting texts, and evaluating information (David, 2008; Hattie, 2009). Research also supports that PBL is a highly engaging and motivating approach that draws more involvement, interest, and

investment in learning from students (Patton, 2012; Mergendoller, Maxwell, & Bellisimo, 2007).

In summation of this section on the effectiveness of PBL, compared to traditional classes, students in PBL classes performed better on assessments of content knowledge (Barron et al., 1998; Hattie, 2009; Katz & Chard, 2004; Mioduser & Betzer, 2008; Peck et al., 1998; Penuel & Means, 2000; Stepien et al., 1993; Thomas, 2000) and emerged with useful, real-world content knowledge that they could apply to a variety of tasks (Boaler, 1997). In addition, students with average to low verbal ability and students with little previous content knowledge learned more in PBL classes than in traditional classes (Horan, Lavaroni, & Beldon, 1996; Mergendoller, Markham, Ravitz, & Larmer, 2006; Mioduser & Betzer, 2008, Thomas, 2000). Students who participated in PBL also benefitted from improved critical thinking and problem-solving skills (Hattie, 2009; Mergendoller et al., 2006; Shepherd, 1998; Tretten & Zachariou, 1995) as well as collaborative skills (Belland et al., 2006; ChanLin, 2008; David, 2008; Edutopia, 2001; Lightner, Bober, & Willi, 2007).

It appears that there is a vast body of research that supports PBL, yet there are few schools across America implementing the model (Bradley-Levine et al., 2010; Doppelt, 2009; Edelson, Gordon, & Pea, 1999; Marx et al. 1994; Ladewski, Krajcik, & Harley, 1994; Marx, Blumenfeld, Krajcik, & Soloway, 1994; Toolin, 2004). In the next section I examine possible reasons for this.

Dissenting Research on PBL

Some research was found that the more traditional instructional methods were more effective in raising student achievement than PBL methods. The outcome of these

studies ($d = 0.18$) were primarily centered on basic science content knowledge (Dochy et al., 2003; Vernon & Blake, (1993). Dochy et al. (2003) and Gijbels et al. (2005) found an overall zero effect size for problem-based learning compared to a traditional learning environment on knowledge ($d = 0.66$). The same study, however, showed that over time the PBL students had better recall of the knowledge and they attributed it to the depth of which they had studied the subject. These researchers also found that the application and principles of the knowledge, rather than the concepts or knowledge, that are most impacted by PBL. Also, Newman (2004) found negative effects for PBL on the accumulation of facts, which may be the major outcome for most studies used for evaluating teaching methods (Hattie, 2009).

In a study by the Cognition and Technology Group at Vanderbilt University (1992), the use of video simulations in which the students worked collaboratively on real-world problems applying mathematical knowledge and reasoning. Students who used the program scored higher than the control group who did not use the program in solving word problems and planning, but much on test of basic math concepts, both groups scored the same (David, 2008).

Challenges Associated with Enacting PBL and Solutions for Improving PBL

Effectiveness

The research on PBL has underscored how difficult it is to implement PBL well, (Bullard & Bullock, 2006; David, 2008). Researchers have deliberately intervened and attempted to improve the delivery or effectiveness of PBL. The intervention may be designed to correct an observed weakness associated with some PBL feature or to remediate or accommodate some student deficiency relative to an aspect of project work.

These interventions, which have been designed to support PBL, have been referred to as scaffolding or procedural facilitation (Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989).

Challenges for Teachers Enacting PBL

Despite the overall benefits to students, PBL is challenging for teachers to implement. Marx et al. (1991, 1997) delineated teachers' enactment problems as follows:

- **Time** - Projects often take longer than anticipated. Difficulties that teachers experience in incorporating Project-Based Science into district guidelines are exacerbated by the time necessary to implement in-depth approaches such as Project-Based Learning.
- **Classroom Management** - In order for students to work productively, teachers must balance the need to allow students to work on their own with the need to maintain order.
- **Control** - Teachers often feel the need to control the flow of information while at the same time believing that students' understanding requires that they build their own understanding.
- **Support of Student Learning** - Teachers have difficulty scaffolding student's activities, sometimes giving them too much independence or too little modeling and feedback.
- **Technology Use** - Teachers have difficulty incorporating technology into the classroom, especially as a cognitive tool.
- **Assessment** - Teachers have difficulty designing assessments that require students to demonstrate their understanding. Finally, the researchers

concluded that change in teachers' learning and behavior tends to take certain forms.

In addition, it was found that teachers generally focused on addressing one or two of these challenges at a time and moved back and forth between old habits and new ideas, incorporating the new information gradually and with varied success (Marx et al., 1994, 1997). Another study cited the challenge that teachers face of incorporating a new instructional approach that requires them not only to reformulate the structure of their classrooms, but also to create alternative assessments (Doppelt, 2009). Teachers also may struggle with perceived beliefs when attempting to implement PBL (Ladewski et al., 1994).

Another challenge with PBL, as identified in research on PBL implementation, was that there is often a poor fit between the activities that form the day-to-day tasks of the project and the underlying subject matter concepts that gave rise to the project (Blumenfeld et al., 1991). Projects sometimes went off track, with teachers and students pursuing questions that are peripheral to the subject matter of interest. The solution, according to Blumenfeld et al. (1991) and Barron et al. (1998) was to find ways for projects to center on learning appropriate goals.

To address these challenges, there is a need for PBL-specific professional development as well as school support structures for teachers engaged in the PBL implementation process (David, 2008; Bradley-Levine et al., 2010; Toolin, 2004) which is discussed later in this review. Other researchers point to the lack of professional development as a challenge for enacting PBL as modifying their practices causes teachers to become beginners again, which often results with teachers feeling vulnerable.

According to Rosenfeld and Rosenfeld (1998), teachers have experienced high cognitive load and uncertainty when enacting PBL, which led them to emphasize skill development over curriculum content leading to the development of superficial student projects. Sage (1996) reported teachers experienced difficulties of developing problem scenarios, aligning problem scenarios with curriculum guidelines, finding the time to implement problems, and facilitating multiple student groups when those groups have students of varying abilities. Teachers also blame the school procedures and policies as a barrier to them enacting PBL. The next section discusses the school confines that might interfere with implementation on PBL.

Challenges Associated with Current School Structures

School factors that facilitate or impede the successful implementation of PBL in classrooms is a popular topic among PBL teachers in schools. Edelson et al. (1999) described a number of practical constraints associated with the organization of schools that interfere with successful inquiry. These factors included fixed and inadequate resources, inflexible schedules, and incompatible technology. To this list, Blumenfeld et al. (1994) added class size and composition, and district curricular policy as restrictions that interfered with enactment of PBL. School factors were the prime impediment reported by Hertzog (1994) in a summary of how well PBL was operationalized in an elementary school setting. According to Hertzog, the physical organization of the school, limitations on time available for learning, and the perceived need on the part of teachers to structure time in or to cover all academic subjects tend to interfere with the effectiveness of PBL for integrating subject matter areas and providing for in-depth learning.

The research shows carefully designed and implemented PBL benefits students. Some research suggest that students have barriers to overcome when learning in this model. The challenges surrounding PBL implementation are explored in the next section of this review.

Challenges for Students in PBL and How Educators Can Help

PBL researchers suggest that a combination of different challenges may impact students (Barron et al., 1998; Brown, 1992; Brown & Campione, 1996; Cognitive and Technology Group, 1991; Edelson et al., 1999; Hmelo, Guzdial, & Tums, 1998; Klein, O'Neal, Dennis, & Baker, 1997; Meyer, Turner, & Spencer, 1997; Polman & Pea, 1997; Scardamalia & Bereiter, 1991; Scardamalia et al., 1989; Sage, 1996). Their suggestions include the following:

- Some students may have difficulty generating the kinds of essential questions that will lead them to encounter and understand the central concepts of a subject matter area. Setting appropriate goals by introducing specifications, asking for design plans, helping students to develop driving questions would assist these students. Practitioners suggest providing students with practice in conducting problem-based learning activities prior to introducing project-based learning.
- Students have difficulty framing questions to guide their inquiry or developing questions that have merit, would need the teacher to provide a structured set of inquiry steps to follow. However, the experts caution that it is unsatisfactory to have a teacher intervene and direct students in their inquiry. It is equally unsatisfactory to allow students to flounder or to put in large blocks of

time exploring unproductive ideas in their investigations. An example of an intervention designed to facilitate students' inquiry behavior is "transformative communication" (Polman & Pea, 1997). The authors point out that project-based learning is often implemented in such a way that students end up engaging in unguided discovery.

- Students may have difficulty with the process of inquiry and might elect to follow unproductive paths. Students having difficulty constructing mental models to guide them through the process may need strategies that help them deal with open-ended situations or problems that are not well defined. These students could benefit from incorporating cognitive coaching (the use of steps to guide beginning inquiry with peer or teacher feedback). This method of coaching allows students to retain control over their project work and students make a decision about a path to take. If necessary, the teacher reinterprets the students' plans and makes additional suggestions.
- Students may be more concerned with getting the work finished than learning. Students are more engaged in schoolwork when they hold mastery goals rather than the goal of completion only. Therefore, emphasizing learning vs. just getting the work finished and understanding vs. product quality as goals for student work are recommended.
- Students who exhibit difficulty with computer skills may tend to be inefficient when working with technology. These might benefit from developing a computer-supported, intentional learning environment in which a student-constructed, collective, database is utilized in order to make knowledge

construction activities overt. Incorporating a technical assistance program that providing on-line assistance to help students learn technical skills and computer programs to help them visualize and construct ideas.

- Students may be used to working with others, but not with collaborating, giving feedback, articulating and synthesizing one's work with that of others or often fail to distribute work equitably on their own. Providing norms for individual accountability and incorporating the jigsaw method, which provides a structure whereby student groups become experts on different topics, then are regrouped to share their knowledge with others.
- Students have difficulty knowing when they comprehend fully. They have difficulty recognizing gaps in knowledge and knowing where they are in the process of knowledge acquisition in the project. Teachers have difficulty monitoring what is being learned and deciding if and when to provide instruction and intervening to require explanations and justifications from students at different stages of the project. Making knowledge building overt, public, and collective through the use of computers or presentations.
- Students sometimes do not take their PBL work very seriously; they do superficial work and rarely revise their products. Incorporating formative self-assessments; creating a classroom culture that supports frequent feedback and assessment; finding ways for students to compare their work with others help to resolve this issue. Giving students explicit responsibility for teaching; providing training in reciprocal teaching opportunities and incorporating presentation opportunities that involve external audiences and requiring

multiple criterion performances (e.g., collaboration, explanation, demonstration, self-report) will also help students take the work seriously.

Both teachers and students have trouble with this complete paradigm shift from a traditional classroom. Fullan (1982) discussed how changes of pedagogical knowledge and understandings involve the difficult process of the construction of new meanings that often run counter to the teacher's knowledge and understandings about teaching and learning. He further emphasized that for educational change to occur, change of general pedagogical knowledge and beliefs is necessary. However, he stated that change on this level is difficult to achieve.

The Relationship Between PBL and 21st Century Issues

PBL provides opportunities for students to learn deep content knowledge and 21st century skills. Although PBL practices vary depending on grade level and subject area, projects should allow for some degree of student voice and choice, and should be carefully planned, managed, and assessed to connect rigorous academic content to 21st century skills (such as collaboration, communication & critical thinking) through student development of high-quality, authentic products and presentations (Mergendoller et al., 2006). Twenty-first century teaching practices and skills were explained well by the William and Flora Hewlett Foundation (2010) concept of “deeper learning” and “student-centered pedagogies” that include models of teaching and learning that are project based, collaborative, foster knowledge building, require self-regulation and assessment, and are both personalized by allowing for student choice and relevance to the individual student, and individualized by allowing students to work at their own pace and according to their particular learning needs. Each of these elements has a strong base of prior research

linking it to positive outcomes for students in terms of development of 21st century skills (Bransford, Brown, & Cocking, 1999; Darling-Hammond et al., 2008; Shear, Novais, Means, Gallagher, & Langworthy, 2010).

In a 2012 study relating PBL to 21st century skills, Hixson, English, and Mergendoller categorized these competencies in the following skill sets:

- **Critical Thinking Skills**, which refer to students being able to analyze complex problems, investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence;
- **Collaboration Skills**, which refer to students being able to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal and to assume shared responsibility for completing a task;
- **Communication Skills**, which refer to students being able to organize their thoughts, data and findings and share these effectively through a variety of media, as well as orally and in writing;
- **Creativity and Innovation Skills**, which refer to students being able to generate and refine solutions to complex problems or tasks based on synthesis, analysis and then combining or presenting what they have learned in new and original ways;
- **Self-Direction Skills**, which refer to students being able to take responsibility for their learning by identifying topics to pursue and processes for their own learning, and being able to review their own work and respond to feedback;

- Global Awareness Skills, which refer to students being able to understand global, geo political issues including awareness of geography, culture, language, history, and literature from other countries;
- Local Connections Skills, which refers to students being able to apply what they have learned to local contexts and community issues; and
- Technology Skills, which refer to students being able to manage their learning and produce products using appropriate information and communication technologies items.

Teachers who used PBL and received extended professional development reported more teaching and assessment of 21st century skills overall, with substantial and statistically significant effect size differences between the groups (Buck Institute for Education, 2011). The findings suggest that PBL use with professional development can have an impact on 21st century teaching and learning (Bradley-Levine et al., 2010; Buck Institute for Education, 2011). Furthermore, teachers of students with a range of student academic performance need to find a way to implement PBL as a way to teach and assess 21st century skills without sacrificing academic rigor.

Assessments that are designed to measure students' gains in 21st century learning skills is a topic that has just recently appeared in the research. Marzano and Heflebower (2012) stated,

Assessment can become a powerful instructional tool when it is used to help students. It can help them articulate clear goals they wish to reach by the end of some interval of time, and it can provide them with feedback regarding their current status. (p.175).

However, Marzano and Heflebower point out that using assessments to do this with 21st century learning skills have not been widely practiced.

After their analysis of the existing research on 21st century learning, Marzano's Research Labs developed a list of cognitive and conative skills that all students must know and be able to do.

Table 1

Cognitive and Conative Skills or the 21st Century

Cognitive Skills	Conative Skills
Analyzing and utilizing information	Understanding and controlling oneself
Addressing complex problems and issues	Understanding and interacting with others
Creating patterns and mental models	

Cognitive Skills: Analyzing and Utilizing Information

- Navigating digital sources involves using electronic resources to find credible and relevant information.
- Identifying common logical errors involves analyzing information to determine how true it is.
- Generating conclusions involves combining known information to form new ideas.
- Presenting and supporting claims involves providing evidence to support a new idea.

Cognitive Skills: Addressing Complex Problems and Issues

- Focus involves the process of directing one's attention to specific issue for an extended period of time.
- Divergent and convergent thinking involves generating multiple options for solving a problem and following a clear line of logical steps to select a specific option or options that will solve the problem.
- Problem solving involves accomplishing a goal in spite of obstacles or limiting conditions.

Cognitive Skills: Creating Patterns and Mental Models

- Basic relationships between ideas involves consciously analyzing how one idea relates to others.
- Creating graphical representations involves creating visual devices that help students organize information into patterns.
- Drawing and sketching involves identifying basic relationships and creating graphic organizers allowing information to be processed in both linguistic and nonlinguistic ways.
- Generating mental images involves creating a picture of information in one's mind in order to process it more deeply.
- Experimenting is the process of generating and testing explanations of observed phenomena.
- Performing mental rehearsal involves creating mental images or sequences.

Conative Skills: Understanding and Controlling Oneself

- Becoming aware of the power of interpretations involves becoming aware that one's thoughts, feelings, beliefs, and actions are influenced by how one interprets situations.
- Growth mindset involves building the belief that each person can increase his or her intelligence and abilities.
- Cultivating resiliency involves developing the ability to overcome failure, challenge, or adversity.
- Avoiding negative ways of thinking involves preventing one's emotions from dictating one's thoughts and actions.

Conative Skills: Understanding and Interacting with Others

- Perspective taking involves identifying the reasoning behind multiple (and often conflicting) perspectives on an issue.
- Responsible interaction involves being accountable for the outcome of an inspection.
- Controversy and conflict resolution involves reacting positively to controversy or conflict. (Marzano et al., 2012)

According to Riel and Becker (2008), all of the PBL teachers who received extended professional development indicated that they had helped provide professional development to other teachers, compared to 33% of the PBL with limited professional development group. This finding about teachers receiving an intensive group offering of professional development in PBL that relates to findings from other studies suggesting that teacher professional engagement is a key predictor of successfully enacting PBL.

Careful attention to these issues will help provide an even better test of the effectiveness of PBL use for teaching 21st century skills. The implications for the future assessments for measuring student achievement is discussed in the next part of this review.

PBL and Future of Student Achievement Testing

The onset of the new student assessment instrument and delivery method of assessing is currently sparking interest in PBL. Advocates of PBL believe that the model will assist students in understanding what is expected of them for future assessment and prepare them for life after K-12 education. The Partnership for Assessment of Readiness for College and Careers (PARCC) and Smarter Balanced are two of the new assessment instruments developed by two multistate consortia awarded funding from the U.S. Department of Education in 2010 to develop an assessment system aligned to the Common Core State Standards (CCSS) by the 2014-15 school year.

PARCC (2012) explained the purpose behind this future assessment by stating, PARCC's next-generation assessment system will provide students, educators, policymakers and the public with the tools needed to identify whether students—from grade 3 through high school—are on track for postsecondary success and, critically, where gaps may exist and how they can be addressed well before students enter college or the workforce. (p. 1)

The PARCC assessments have six purposes, which are driving the design of the system. The priority purposes of PARCC Assessments include determining whether students are college- and career-ready; assessing the full range of the CCSS, including standards that are difficult to measure; measuring the full range of student performance;

providing data during the academic year to inform instruction, interventions and professional development; providing data for accountability, including measures of growth; and incorporating innovative approaches throughout the assessment system.

To address the priority purposes, PARCC has developed an assessment system design that includes a mix of constructed response items, performance-based tasks, and computer-enhanced items. The PARCC assessments will be administered via computer, and a combination of automated scoring and human scoring will be employed (Partnership for Assessment of Readiness for College and Careers, 2012).

The Smarter Balanced Assessment Consortium (2012) is a state-led consortium working to develop next-generation assessments that measure student progress toward college- and career-readiness. It is reported by the consortium that the work of Smarter Balanced is guided by the belief that a high-quality assessment system can provide information and tools for teachers and schools to improve instruction and help all students succeed. Smarter Balanced claims to involve educators, researchers, policymakers and community groups working together in a transparent and consensus-driven process; be guided by the belief that a balanced, high-quality assessment system, including formative, interim, and summative components, can improve teaching and learning by providing information and tools for teachers and schools to help students succeed; and that timely and meaningful assessment information can offer specific information about areas of performance. Teachers can follow up with targeted instruction, students can better target their own efforts, and administrators and policymakers can more fully understand what students know and can do, in order to guide curriculum and professional development decisions. Smarter Balanced

assessments will include multiple-choice questions, short constructed response, extended constructed response, and performance tasks that allow students to complete an in-depth project that demonstrate analytical skills and real-world problem solving.

Both consortiums claim that the CCSS provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that students need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy, which connects with the goals of 21st century learning. Therefore, both Smarter Balanced and PARCC are developing assessment systems aligned to the CCSS in English language arts/literacy and mathematics with the goal of preparing K-12 students for college and career.

However, according to Smarter Balance there are key differences between the two. For example, Smarter Balanced assessments will use computer adaptive technology, while PARCC will use computerized assessments that are not adaptive. Smarter Balanced assessments make use of computer adaptive technology, which advocates claim is more precise and efficient than fixed-form testing. Stakeholders will be able to receive results from computerized assessments in weeks, which will aid educators in using the information from interim assessments throughout the school year to differentiate instruction and better meet the needs of their students. Researchers from the Buck Institute believe that PBL projects that are carefully planned, managed, and assessed will help students learn key academic content, practice 21st century skills such as collaboration, communication and critical thinking, and create high-quality, authentic

products and presentations which will in turn make students excel in the area of new standardized testing will assessments such as PARCC and Smarter Balance (Buck Institute, 2012).

Since the state legislature, in the summer of 2013, made it illegal for the state to join an assessment consortium; therefore, the state will most likely develop their own assessment to replace the current state standardized test, which will be focused on the components found in the PARCC and Smarter Balance assessments.

PBL and the Use of Technology

A constructivist approach to learning with technology provides a more effective method for teaching students to think and to learn in all aspects of education.

Constructivists contend that knowledge is constructed, emergent, and grounded in action or experience (Jonassen, Peck, & Wilson, 1999; Wertsch, 1985). The work of Jonassen et al. (1999) not only argued for a change in the dominant traditional teaching methodology, but also provided concrete examples of activities for using constructivism and technology to allow students to construct knowledge, to think and to learn.

Constructivist learning emphasizes the following aspects of intentional learning: active learning, constructive learning, cooperative learning, and authentic learning. Real learning requires combining the different elements of meaningful learning. Ways to use technology and constructivist learning allows students to construct understanding and learn. The Internet can be used to allow students to construct complex knowledge bases, find information, create and build information through designing web sites, and communicate and share knowledge. Empowering learners to construct knowledge through active learning and the creation of learning communities can be achieved through

the use of the Internet as a learning tool. Jonassen et al.'s work (1991) gives a different way to think about technology in the classroom and how technology can best be employed in the learning process.

The Buck Institute for Education offers PBL teachers innovative, safe technology tools such as Edmodo, Think-Quest Projects, Project Foundry, and CK-12s Flexbook Tool. These streamlined tools create avenues for teachers and students to collaborate, explore topics, share content, engage in meaningful academics, provide an environment that scaffolds the learner's PBL experience, and helps to manage projects (Buck Institute for Education, 2012). Constructivism partnered with PBL and technology may provide the impetus necessary to reform education.

Summary of Literature Review

The review of literature revealed that PBL is focused on experiencing content and not just learning content. It involves in-depth investigation of a real work topic and is away for students to develop true understanding of concepts by making connections and developing their own meaning (Henton, 1996; Perkins & Salomon, 1998; Vygotsky, 1978). An argument can be made that the connections made by students, which are facilitated by teachers, lead to construction of knowledge based their experiences.

Momentum in the PBL movement may be difficult in a time when a much larger and more vocal contingent is pressing for more emphasis on standardized testing, statewide standards, and increased accountability on the part of teachers and schools; all emphases that tend to move schools in the direction of traditional, teacher-directed instruction (Henton, 1996; Stites, 1998). The PBL research reported in this review may be met by with resistance by some in education with the current concerns of classroom

teachers because of the accountability movement, recent pressure to teach skill-based instruction that match standardized tests, and the most recent teacher evaluation systems.

Teachers new to PBL may continue to use the customary processes of systematic, direct instruction to cover the content of the project and have children produce prescribed results as the teachers' thoughts based on preexisting general pedagogical knowledge. Those beliefs may prevent them from recognizing that there are other ways to offer opportunities for learning in their classrooms—some that are likely to develop their children's intellectual capabilities as well as foster their academic skills (Katz & Chard, 2000). Thus, there is a need for expansion of some of the PBL research reported above, coupled with a systematic effort to build a knowledge base that will be accessible to educators that will help educators and students prepare for future student achievement assessments and more importantly, life in the 21st century.

Research on PBL has not had a substantial influence on PBL practice; therefore, there has not been a widespread acceptance and implementation of PBL. There are a number of reasons for this. Lack of information on what PBL practices are most productive and an overall framework to guide planning and collaborations, lead PBL practitioners in a vulnerable position unable to justify their practices or to sustain their work long enough to become experts at it.

Additionally, planning for PBL is time consuming and complex whereas practitioners in traditional classrooms have access to texts, tests, and other materials readily available. PBL practitioners are in a position of having to construct a unique instructional model almost completely on their own without guidance, texts, resource materials, or support. This knowledge leads to the conclusion that PBL teachers need

professional development, school and district support, and opportunities to collaborate in order to plan and enact PBL effectively. This will help students who need support in setting up and directing initial inquiry, organizing their time to complete tasks, and integrating technology into projects in meaningful ways. Even teachers who have recently entered the teaching profession have not been exposed to research on PBL, nor are they expected to have taken courses in the theory and practice of PBL. Findings suggest careful attention and thoughtfulness is considered in embracing PBL unless atmospheres for success are in place, including well-developed and defined projects, collaborative culture, and strong school support (David, 2008).

Teachers also need to further study and begin to understand motivation and student engagement strategies. According to Blumenfeld et al. (1991), previous attempts at hands-on and discovery-learning curricula failed to reach widespread acceptance because developers did not base their programs on “the complex nature of student motivation and knowledge required to engage in cognitively difficult work,” (p. 372) nor did they give sufficient attention to students' point of view.

Various explanations have been found for why PBL has not taken hold in public schools and continues to come and go from the educational scene, even though there is evidence that PBL can be successful. Barron et al. (1998) stated,

As a nation we are in danger of once again failing to realize the educational potential of these emerging approaches. If curriculum changes are not made carefully with adequate planning and support, we risk a political backlash that favors back-to-basics and rote learning over authentic inquiry (p. 311).

Schools must continue to find ways to acquire up-to-date technology and get it into the hands of students. Technology is merely a tool to enable students to construct knowledge. Understanding cannot be conveyed to students through teachers or technology; rather, students construct understanding themselves through tools such as teachers and technology by demonstrating specific examples of how the tools of technology can be employed to empower students to construct knowledge and meaning (Moursund, 1999; Lechner, 2001).

A widely accepted framework, theory, or definition of PBL is needed. One of my goals in this research of literature was to understand what particular features must be present or absent in order for an instructional activity to be considered PBL. I found that the features most often mentioned throughout the literature are: centrality, driving questions, constructive investigations, autonomy, and real-world application. The development of websites readily available will serve educators well as they continue to discover the specific aspects and benefits of PBL.

Continued evidence of the effectiveness of PBL in comparison to other methods is necessary. This research was needed not only to guide PBL instruction and the development of projects, but also to provide justification and for the ease in implementation in our schools.

One of the goals set out in my research was to investigate parent perceptions surrounding the implementation of PBL. I found very little research addressing this topic but what I did find supported PBL leading to the perception that even though the project experience was new to the parents, by the end of the project, the parents agreed that the project enhanced their understanding of their children's learning, enhanced their daily

communication with their children and developed good teacher-parent relationships. In the study that included parent perception of the PBL experience, Yuen (2009) reported one parent, when referring to her son, stated,

It's made him (child) more willing to learn and more confident in sharing and presenting his idea. The project was valuable for my child because it taught him to undertake in-depth study of real-world topics, commit to his investigation, and negotiate with other children. It was a team effort, a fun and memorable way to learn to work together. I thought the exhibition provided a good opportunity to understand children's work. I understand how the children integrated their thinking into drawing and how they used simple words to express themselves. It's always fun for parents to see what their kids are doing in school (p. 31).

Additionally, practical experiences that I have encountered throughout my research have led to the conclusion that educators must communicate with parents about the importance of their children being engaged in PBL for preparation for the real world after their K-12 experiences. It is important that parents understand the need for our students to develop 21st century skills as it relates to future student achievement assessments and workplace expectations. We need to clear up any misunderstandings about PBL and reassure the parents that PBL is not group grading nor will it take high-level honors opportunities away from their children. It appears that there is little research involving parent perceptions of PBL. It is my goal to help fill this void in the research with my work.

CHAPTER 3: RESEARCH METHODS

In this chapter, I describe the research methods utilized in this study and the rationale for each. Chapter 3 is organized in a way that presents the purpose of the study and the research questions. Then, the research design, description of sample, and background experience sections follow. Next, the instrumentation and data analyses are presented. Finally, the limitations of the student and summary conclude the chapter.

Purpose of the Study

One purpose of this study was to examine the perceived differences between a PBL classroom and those of a more traditional classroom. Another purpose of this study was to discover which students, parents, and teachers chose PBL over the more traditional setting and why they made that choice. Student achievement results of both methodologies were examined, and stakeholders' perceptions surrounding PBL were collected, analyzed, and interpreted. The goal was to contribute participants' perspectives for the benefit of scholars, administration, teachers, parents, and students. The study also served to provide program evaluation data to the school's leaders to guide future decision-making regarding PBL in the school and district.

Research Questions

Accordingly, the research questions that guided this study were:

1. In a suburban high school giving the students the choice to engage in PBL, what effect does PBL have on student achievement?
2. How do the perceptions of students and parents in the PBL setting compare to the perceptions of student and parents in the traditional setting?

3. What are the perceptions of teachers in a traditional setting, teachers in the PBL setting, and with administrators surrounding both learning models?
4. If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why?

Research Design

To answer the research questions, I utilized a mixed-method approach employing both quantitative and qualitative research methods. An exploratory design, where both methods were used sequentially in a single study, provided results with great breadth and depth (Roberts, 2010). This combination of quantitative and qualitative research design with a grounded theory approach was used to collect data from participants and analyze responses. Through my use of this approach, I reviewed the collected data throughout the research process and made adjustments to the study as needed (Glaser, 1998). It was my purpose to test theory and contribute participant perspective knowledge in this field for the benefit of scholars, administration, teachers, parents, and students. Hopefully, this study provides program evaluation data to school leaders to guide future decision-making regarding PBL in the school and district.

The quantitative component is an ex post facto or a causal-comparative design that seeks to find the relationship between teaching methods and students' average achievement scores. The "qualitative research tells the story from the viewpoint of the participants that provides rich descriptive detail" (Roberts, 2010, p. 145).

Description of Sample

I focused this study on the 2012 freshman class of a high school located in central Indiana that had a student population of nearly 1,700. I selected this school because it

was the second year of offering the students a choice of PBL classes or traditional classes for certain subjects. The high school had three buildings which made up the campus; a ninth grade center, one building housing 10-12 graders, and an alternative school for juniors and seniors who needed credit recovery and online delivery of instruction.

The original proposal, presented to the Board of School Trustees on March 21, 2011, called for all freshmen to follow PBL approach in the upcoming school year. The Department of Education awarded the school a Classroom Innovation Grant of \$100,000 to fund this initiative. The late notification limited the corporation's ability to discuss and share the various elements of the proposed program with all parties. This late notification, in conjunction with numerous parental questions, led the corporation officials to alter the proposal to offer the PBL program only for freshman students who elected to participate this past school year. If freshmen students chose to participate in the program, they were in a combined credit block of biology, computer applications, and career curriculum, which met the prescribed Indiana requirements for all three areas.

At the beginning of this offering, 94 students out of 348 students chose the PBL methodology for those subjects. There were three full sections of the PBL program with a block schedule of 90 minutes daily for the entire year. Three biology teachers and two business teachers employed team teaching, PBL approaches to deliver the instruction. If freshmen students chose to participate in the program, they were in a combined credit block of biology, computer applications, and career curriculum, which met the prescribed Indiana requirements for all three areas.

The school offered the 2012 freshman group the same opportunity to participate in PBL classes for three new subjects as sophomores. I collected data to investigate why

some students, along with their parents, and some teachers selected to be engaged in the PBL approach during the students' sophomore year and why some students, parents, and educators did not. Thirty-eight sophomores enrolled for the 2013-2014 school year in the PBL for the combined class of world history, digital design and art history. Students were instructed by one biology teacher and one business teacher. Sixty-eight sophomores for the 2013-2014 school year were in PBL classes combining antiquities and design (ANDE), world history, art history and digital design. These students were in two classes that were led by one history teacher and one art teacher. Ninety freshman students enrolled in the same year (2013-2014) in biotech, which was composed of biology, digital citizenship, and preparing for college and career classes that were instructed by three biology teachers and two business teachers.

Background of Experience

In order to build an experience base for understanding PBL, I visited two different schools outside of the study during the time that I was writing the literature review. In these schools, I observed PBL classrooms, which included grades kindergarten through high school. I collected artefacts from a variety of PBL classrooms as part of the process to build a knowledge base. This new experience, coupled with my experience as both a classroom teacher and a building administrator in a traditional setting added to the richness of this study.

Instrumentation

When developing the instruments for this study, I relied heavily on my research questions to ensure proper alignment between the tools that I utilized in the study and the research questions I sought to answer. I included an alignment matrix in Appendix B. I

developed both quantitative and qualitative instruments that are described in the next section.

Quantitative Instrumentation

Student Achievement. The quantitative portion of this study included collecting and analysing the student achievement test results as I compared student achievement measures on the ECAs, previous ISTEP+ results, course tracking records (honors, Core 40 classes), and grade achievement data of students who were involved with PBL delivery of instruction as those compared to in the same classes with a traditional teaching and learning approach.

Survey. I developed a survey in Qualtrics and utilizing a Likert scale format that was offered to all students and one parent/guardian who represented each student who was involved in making the choice between the PBL classes and traditional classes. The survey was distributed at the end of the students' sophomore year and indicated whether or not they enrolled in PBL for the second year, and why they made their decision. They also indicated if they had made the choice to continue PBL into their junior year.

The survey also captured which features of classroom instruction were most valued by students and parents and which features of classroom instruction were least valued by student and parents. This data were critical to better understand why some participants chose traditional or PBL settings, which is at the heart of my study.

The applicable participants were asked to rate their experiences with PBL at the high school as part of a program review for the district. There were five categories that emerged from my literature review on PBL methodology that were used to develop this part of the survey. Using this information from my literature review, I intentionally

clustered the survey questions into related sections. These constructs aided in ensuring reliability of answers within each construct and expedited data analysis. Each block of the survey focused on one construct and had five questions within the block. The constructs (a) student achievement, (b) authentic connections to the real world, (c) problem solving and critical thinking, (d) student motivation, and (e) strengths and barriers to implementation.

To ensure that the validity of these survey questions represented what I intended and claimed them to represent; the survey was tested via a set of experts before the study was launched. This process helped to establish the survey's generalizability and ensured that the questions were rigorous enough to ensure the concepts I set out to measure.

As the initial survey was developed, copies were distributed to the following experts for their critique of the validity of each item of the survey and interview questions: Dr. Marilyn Quick, Ball State University Assistant Professor, Specialist and Doctoral Academic Advisor; Dr. Serena Salloum, Ball State University Assistant Professor; Dr. J. T. Coopman, Executive Director of the Indiana Superintendent Association; Dr. Cameron Rains, Clark-Pleasant Community School Corporation Assistant Superintendent; Dr. Kianré B. Eouanzoui, Ball State University Statistician, Research and Academic Effectiveness; and Dr. Jarrod Burns, Green Meadow Elementary School Principal. These experts provided recommendations for improving survey items and interview questions. The instruments were altered and improved based on the suggestions made by the expert panel and my dissertation committee.

To ensure reliability of my survey instrument, I used the Test-Retest Reliability Method. KAPPA coefficient was computed to analyze group administrations of the

survey. I looked for variation in responses from the first to second administration after one week. Items determined not to be reliable through the KAPPA cross tabulation were examined. I administered the survey to 30 high school students, and then a week later gave the same 30 students the same survey to check for consistent answers. The test of the survey was not distributed to anyone who was included in the study sample. I decided the responses were reliable if the Pearson correlation coefficient was $r = \geq 0.70$. Adjustments were made in the survey as needed, and the test was re-administered. Dr. Kianre B. Eouanzoui, Ball State Statistician assisted me in running the data so we could check for reliability.

Qualitative Instrumentation (Interviews)

As typical in qualitative research, I was the instrument, as I developed the interview protocols. The interview questions were further developed from the survey results in order to collect more in-depth information. Through interviews with the participants, I was able to ask open-ended questions and follow-up questions in order to gain in-depth responses. After analysing the quantitative data, I conducted eight student and parent interviews; four who selected opting into the PBL model and four who had chosen the more traditional model for the sophomore year. I also interviewed three teachers and two administrators who were involved with the PBL approach. The interview protocol was different for each group of participants, but within each group some of the questions were the same so that comparisons could be made.

Data Collection and Procedures

After obtaining approval by the Ball State University Institutional Review Board and the superintendent of Community School Corporation, I began the data collection

process. As part of the program review for Community High School, I was granted access to student records as the school had the educational reason of program evaluation for wanting to examine student information and kept all students' identities confidential.

I used the appropriate release statements for all parties involved. It was extremely important to communicate to all possible participants with letters of introduction, which explained my studies and that their participation in this research study was strictly voluntary. Inclusion of informed consent forms with permission to conduct the study was sent to all administrators, teachers, parents, and students to ensure the rights of human subjects. A statement that the study involved research, an explanation of the purposes and a timeline of the research, a description of the procedures followed, and ensured prior knowledge of when surveys and interviews was coordinated with all parties involved (Roberts, 2010).

Quantitative data were collected from the student participants through online surveys administered by me in person during the school day. If students were absent the day I surveyed, I returned to ensure each student had a chance to participate. The parents' survey was sent via email. After the initial survey was sent out to parents, I waited one week and sent out a reminder email. I sent out a third email to parents one week later.

Qualitative data were collected through interviews using an ethnographic interview approach, utilizing a semi-structured format while keeping the tone of the interviews conversational. Through a more open-ended approach, I was able to discover the reoccurring behaviors and relationships. For further analysis, I audio recorded each interview and contracted with Cabbage Tree Solutions to obtain a written transcript of

each one. After working with Dr. Quick to review two of my administrators' interviews, I returned a second time to expand on some questions that I had not probed enough to obtain the full response. This was part of the learning process for me in terms of using the instrument and helped as I continued to conduct interviews with all stakeholders.

Students and Parents Interviews

Parents provided their contact information at the end of the survey if they were interested in participating in the interviews or if they gave permission for their student to participate in the interview. Although the survey results were confidential, I needed the assistance of a central office administrator to help to determine, from survey of responses, which students and parents (who chose PBL for a second year and those who elected to withdraw from PBL classes after the first year) would be included in the interviews. The administrator agreed to maintain confidentiality.

Ideally, I wanted at least six students who represented students of varied abilities involved in PBL and one of each of their parents who would agree to be interviewed. I was only able to obtain four sets of students/parents who agreed to be interviewed, but they did represent a variety of abilities and program choices. I recorded the interviews and transcribed the interviews using the same service as used with the educators.

In an effort to put the parents and students at ease during the interview process, I conducted the interviews at a neutral location, including a local coffee shop, a local restaurant, and one of the schools in the corporation as chosen by each participant.

Questions for students and parents included the following:

1. What motivates a student to choose a PBL or traditional approach to coursework?

2. Why was the decision made to choose PBL instruction over a traditional instruction or vise-versa?
3. What do you think worked well in PBL settings and/or traditional settings and what needed to be improved in each setting?
4. What, if anything, contributed to your or your child's success in the PBL or traditional experience?
5. What changes would improve your school experience?
6. What kind of student do you consider yourself (or your student) to be?

Teachers and Administrators

I interviewed four teachers and two administrators who have been involved in the integrated courses throughout the last two years. The development of the interview protocol for teachers and administrators revolved around the necessary components identified from Markham's (2003) work, and included:

1. In what ways were the challenge and the project aligned with the objectives of this course?
2. How was the driving question crafted?
3. What is the deep understanding that teachers want students to demonstrate at the end of the project?
4. What is the process that has been followed for turning a challenge into a driving question?
5. How were assessments built?
6. How was backwards design used in planning projects?

7. In what ways did the teacher coach students through the collaborative process?
8. Were the students engaged in the project and how was that measured?
9. How well did we facilitate the high-performing teams? How was this measured?
10. What methods were utilized by the school community to communicate all aspects of PBL to the parents of the students involved?

I protected the confidentiality of participants by keeping all surveys, interviews, and student records with achievement electronically password protected and ensured participants that I would not misuse the information collected or break confidentiality by sharing documents inappropriately. All surveys had a student code that was identifiable only for the purpose of choosing students and parents to interview and for student achievement data analysis in addition to the participants who willingly provided their contact information on the survey.

Communicating my intention with this work and following my promises of confidentiality was of critical importance. The survey results and the interview transcripts were only reviewed in my home or office and are destroyed after Ball State University has accepted my work.

Data Analysis

With the assistance of the administration at the high school and the corporation curriculum director, I obtained the ECA student achievement data. The information was coded with a student ID number. I examined the effect of teaching methods on students' achievement scores by comparing the average achievement score in the PBL teaching and

traditional teaching method groups; therefore, a *t* test answered the question whether or not there was a statistical significant difference between PBL and traditional teaching methods. I examined previous ISTEP+ data to be able to make comparisons between students. Therefore, to do these comparisons ANOVA was employed since I examined more than two variables.

In-depth, open-ended interviews assisted me in understanding participants' perceptions and why some chose to continue in the PBL model and others chose a more traditional approach to teaching and learning. The quantitative data were analysed within each survey construct, as well as each individual item on the survey. This data were compared to four groups of respondents including (a) students who chose to stay in PBL for a second year, (b) parents who chose to have their student stay in PBL for a second year, (c) students who chose to leave PBL after the first year, and (d) parents who chose to have their students withdraw from PBL after the second year. Responses from students and parents were also analysed and interpreted across each construct and each survey question. I used a five-step process (Roberts, 2010; Tesch, 1990) for analyzing interview transcripts. Those steps were as follows:

- Step 1. Initial reading of transcripts and get a sense of the whole. After all interviews were transcribed, I reviewed all data and developed a preliminary list of categories, themes, and patterns that emerged from the interviews. Each theme was given an initial coding.
- Step 2. Organization and coding of responses. The responses were sorted and grouped by research questions. A master coding list of response categories within each research question was counted by frequency.

Step 3. Review of total transcripts and final coding. Using the master-coding list developed in Step 2, I coded the full transcript of each participant and the final coding list was finalized by using the most descriptive wording for the categories.

Step 4. Completion of data analysis and report of findings. The analysis of each interview transcript was conducted and themes, patterns, and categories for the research questions were developed.

Step 5: Review of the total transcript to ascertain validity of findings. Analyze the trustworthiness of the data using techniques such as triangulation of data and inter-rater reliability were utilized.

Limitations of Study

As many researchers have found, surveying has limitations. Although I had relationships with some of the participants in this study, I did not have trust established with all of parties involved. Because I did know some of the participants, I worked extremely hard to be sure not to include my own biases. Initially, I was afraid that those being surveyed may not have been as open as I would have liked due to my being an administrator in the district, but I did not find that to be an issue. I began with candid conversation and was thorough in the explanation of my role in this study.

There were also ethical issues in surveying and interviewing children and I centered on protecting them from harm as a result of participating in the study, protected their identities and privacy, and was diligent to ensure that they willingly participated in the study (Marshall & Rossman, 1999). My first priority was to ensure that I did no harm.

After analyzing the results, I discovered that “inquiry-based learning” may have been a term that participants were not familiar with and I could have explained it more specifically on the survey. This may have resulted in deeper analysis. As stated in Chapter 1, this study included one school district with administrators, teachers, parents, and students who had the option of choosing PBL or traditional programming. Because the total number of participants was small, the results of this study were not fully generalizable.

Summary

PBL advocates believe learners with different skills and backgrounds should collaborate in tasks and discussions to arrive at a shared understanding of the truth in a specific field and students should play an active role in learning. Learning should become a reciprocal experience for the students and the teachers (Duffy & Jonassen, 1992; Wertsch, 1985). Typically speaking, schooling in the United States has been set up as an individual journey and with ability-grouped or tracking of students by ability through the upper grades in the K-12 system (Wertsch, 1985). I was able to explore the students’, parents’, teachers’, and administrators’ perceptions of this traditional design in comparison with PBL. Overall, I found this topic to be one that I am passionate about and was truly interested in what I discovered through my research endeavors.

CHAPTER 4:

RESULTS

This study was conducted to learn more about the perceptions of those involved in both PBL and traditional classes. Therefore, a mixed-methods approach was embraced for this study to provide a richness that would capture all aspects of the topic including the feelings and emotions of those who chose each type of learning. This chapter is organized by research questions to include both quantitative and qualitative findings. I used this design method as mixed-methods approaches lend themselves well to the triangulation of data and identifying ways to converge data, increasing the usefulness and validity of the findings (Creswell, 2012). This chapter is organized to include (a) the purpose of the study, (b) research questions, (c) quantitative data analysis, (d) qualitative data analysis, and (e) triangulation of data.

Purpose of the Study

One purpose of this study was to examine the perceived differences between PBL classrooms and those of a more traditional classroom. Another purpose of this study was to discover which students, parents, and teachers chose PBL over the more traditional setting and why they made that choice. Student achievement results of both methodologies were examined, and stakeholders' perceptions surrounding PBL were collected, analyzed, and interpreted. The goal was to contribute participants' perspectives for the benefit of scholars, administration, teachers, parents, and students. The study also served to provide program evaluation data to the school's leaders to guide future decision-making regarding PBL in the school and district.

Research Questions

The following research questions guided this study:

1. In a suburban high school giving the students the choice to engage in PBL, what effect does PBL have on student achievement?
2. How do the perceptions of students and parents in the PBL setting compare to the perceptions of student and parents in the traditional setting?
3. What are the perceptions of teachers in a traditional setting, teachers in the PBL setting, and with administrators surrounding both learning models?
4. If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why.

Participant Demographics

Students and parents participated in providing quantitative data for this study. A total of 221 students were included in the achievement analysis. This was archival data so there was 100% participation. To compare the SES of those in both programs, lunch status of the students was examined. Of those in the traditional program, 103 students (68%) were paid meal status, 14 students (9%) received reduced meal prices, and 34 students (32%) received free meals. The status for those students in PBL was paid meals 45 (64%), reduced meals six (8%), and free meals 19 (36%). Therefore, the PBL and traditional groups were similar in SES. There was little ethnic diversity of students included in the study as 86.6% of the students who chose traditional programming were White and 87.6% of the students who chose PBL programming were White.

To answer the research questions, the survey was distributed via email in November 2015 to 381 families. Despite repeated reminders and personal requests, 56

surveys were started and 47 were completed (19 students and 28 parents) for a response rate of 12.35%. The program review portion of the survey was distributed to 70 students and 70 corresponding parents ($n = 140$). Thirty-nine surveys were completed (16 students and 23 parents) for a response rate of 27.86%.

The survey provided information for two concepts. First, I was able to determine those classroom features that were most and least valued by students and parents. The next section of the survey provided a program review. In other words, students and parents who had been involved in PBL provided their judgments about whether the program had met their expectations, compared to their traditional programming experiences.

Quantitative Data Analysis

This section describes the results of the quantitative data analysis. First, I describe how inferences were made from the data starting with an analysis of student achievement followed by a discussion of the survey results from students and parents. Additionally, results from the program review from students and parents, which was an additional section of the survey, are described. The narrative is organized by research questions. The quantitative data analysis assisted in answering Research Questions 1, 2, and 4. Each section begins with descriptive statistics. Both descriptive and inferential statistics were used to guide the analysis.

Student Achievement: Research Question 1. In a suburban high school giving the student the choice to engage in PBL, what effect does PBL have on student achievement? The achievement data from 151 students who chose the traditional setting and 70 students in PBL were analyzed for a population of 221 students. The 151 students

who chose traditional classes over PBL classes included 77 female students and 74 male students. The PBL classes included 27 female students and 43 male students ($n = 70$).

Two determinations were made which were

1. More students (68%) chose traditional over PBL programming, and
2. More male students (61%) chose PBL programming than female students (39%).

To answer Research Question 1, student achievement data were analysed by comparing the measures on the end of course assessments (ECA) to previous ISTEP+ results. Table 2 organizes the results from this analysis.

Table 2

Comparison of Students' ISTEP and ECA Results by Numbers and Percentages by Coursework

Course	<i>N</i>	% Pass ISTEP	% Pass ECA	# Passed ISTEP but Not ECA	% Passed ISTEP Not ECA	% DNP ISTEP	# DNP ISTEP but Passed ECA	# DNP ISTEP or ECA	% DNP ISTEP or ECA
Traditional Biology 1	100	62.00%	83.87%	10	16.13%	48.00%	5	33	86.68%
Traditional Honors Biology	51	100.00%	98.03%	0	0.00%	0.00%	0	0	0.00%
PBL Biology 1	56	57.14%	96.87%	1	3.13%	42.86 %	2	22	91.67
PBL Honors Biology	14	85.71%	71.43%	4	28.57%	14.28%	0	2	14.29%

As shown in Table 3, the traditional honors biology student data set included 51 students. All of these students passed eighth Grade ISTEP. All but five students in that group (98.03%) passed the honors biology ECA. Analysis of this information suggested

that those who did not pass ISTEP as eighth graders did not pass the biology 1 ECA after traditional schooling. Conversely, those who passed the science ISTEP were on track to pass the ECA.

There was a slightly higher percent of passing ECA scores for those students in PBL biology 1 than those in traditional biology 1. The data suggested those students who passed ISTEP as 8th graders passed the ECA in biology in high school whether they were in PBL or traditional coursework. Also, no traditional honors biology 1 students failed both the ISTEP and ECA compared to 14.29% of the PBL biology 1 honors students who failed both tests. This data also revealed that most students were in traditional biology 1 classes over all other programming.

Matching Groups. In order to compare student achievement results between students who participated in PBL and those who had participated in traditional programming, I created two groups with matching demographics. Beginning with data from those students who had complete pre-test and post-tests scores, I was able to develop a data set of 140 students to use as a matching comparison group between traditional and PBL settings. I created the matching groups sorted first by gender, then SES, and matching pre-scores from biology 1 or biology honors programming. Pre-scores represented each student's sixth grade science ISTEP score. When there was more than one match for a PBL student from the traditional list based on sorting by the criteria,

I used a random number generator to select the matching student in alphabetical order by last name. This method worked well for most of the data, but a limitation was found as I continued to match the data. After the initial effort to find matching data, I needed to expand the criteria to 13 male students and two female students in the PBL

group outside of their SES area. I then determined that if the match on the science pre-test score was >7 difference between the traditional and PBL, then the science score would be weighed higher than SES.

After completing the matching process, I then conducted a matching group data analysis to ensure the pre-test groups were similar. This analysis revealed that the pre-test of science ISTEP scale score mean for the 70 students in the traditional group was 513.42 and the mean for the 70 students in the PBL group was 511.04. An ANOVA test suggested that there was no statistical significance difference between the pre-test PBL group and the traditional matching group ($p = >.754$). This analysis confirmed that the students included in the matching data set were highly similar, and I was confident that the groups of students' data between the traditional and PBL programming match could be used for further analysis.

Using the matching group data between the control and experimental groups, I compared the pretest, the ISTEP eighth grade science scaled score, with the post-test, which was the end-of-course high school biology scaled score. To understand differences on students' achievement scores between the two groups, I compared the average achievement score in the PBL teaching and traditional teaching method groups. Therefore, a t test was utilized to answer the question of whether or not there was a statistical significant difference between PBL and traditional teaching methods. In comparing the pre- and post-test scores, the means of the scores progressed from 513.42 to 518.63 within the traditional programming student group. The means of scores declined from 518.63 to 497.93 in the PBL student group.

At first glance, it appeared that the PBL group of students' achievement declined, but it was necessary to run further analysis to understand if the differences in the scores were statistically significant. A series of multivariate tests, including Pillai's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root, were used to determine that there were no statistical differences between groups when comparing PBL to traditional student achievement. Similar tests, including sphericity assumed, Greenhouse-Geisser, Huynk-Feldt, and lower bound, all revealed the same result. In other words, to answer the research question surrounding student achievement results, all analyses reveal that there were no statistical differences between groups. This result indicated that PBL had no effect on student achievement compared to the traditional group.

Survey: Research Question 2. How do the perceptions of students and parents in the PBL setting compare to the perceptions of student and parents in the traditional setting? The survey results are discussed in this section beginning with the results revealing which classroom features were most and least valued by all participants (those choosing PBL or traditional). The following section presents the participants' program review results, which were completed only by those who had experienced PBL programming.

Most and Least Valued Classroom Features. How do the perceptions of students and parents in the PBL setting compare to the perceptions of student and parents in the traditional settings? Table 3 notes the participants in this portion of the survey.

Table 3

Survey Participants

Participants	Students	Parents
Male respondents	5	6
Female respondents	14	22

Forty-seven survey participants chose three classroom features that they valued most and least in the classroom based on the PBL research. Table 4 displays the results from this part of the survey.

Table 4

PBL and Traditional Participants' Responses by Frequency and Percentages of Classroom Instruction Most and Least Valued

Classroom Features	Value	Total Responses	PBL Frequency	PBL % of total Selecting Feature	Traditional Frequency	Traditional % of total Selecting Feature
Preparation for the real world in which we compete for jobs	Most	27	17	48.6%	10	28.6%
	Least	8	5	14.3%	3	8.6%
Critical thinking skills are learned that lead to solving problems	Most	20	14	70.0%	6	30.0%
	Least	0	0	0.0%	0	0.0%
Preparation for the college and career readiness skills that will be assessed on new state achievement tests	Most	20	13	36.1%	7	19.4%
	Least	16	8	22.2%	8	22.2%
Motivates the students to take an active role in learning	Most	19	10	37.0%	9	33.3%
	Least	8	5	18.5%	3	11.1%
Work collaboratively with people with different skills and backgrounds	Most	14	10	33.3%	4	13.3%
	Least	16	11	36.7%	5	16.7%

Table 4 (continued)

Classroom Features	Value	Total Responses	PBL Frequency	PBL % of total Selecting Feature	Traditional Frequency	Traditional % of total Selecting Feature
Students become proficient communicators	Most	15	6	24.9%	9	36.0%
	Least	10	7	28.0%	3	12.0%
Students drive their own learning through inquiry	Most	9	5	17.9%	4	14.3%
	Least	19	10	35.7%	9	32.1%
Opportunities to enhance use of technology	Most	9	6	27.3%	3	13.6%
	Least	13	9	40.9%	4	18.2%
Instruction promotes the students' deep understanding of course contents	Most	8	6	40.0%	2	13.3%
	Least	7	5	33.3%	2	13.3%
Grading is based on collaborative efforts of the entire group	Most	0	0	0.0%	0	0.0%
	Least	44	27	61.4%	17	38.6%

As the data in Table 4 revealed, participants selected the feature of preparing students for the real world in which we compete for jobs as the most important classroom instruction feature. It was interesting to note that 48.6% of participants who selected this feature were involved in PBL compared to 28.6% of traditional programming participants. This suggested a possible reason for choosing PBL over traditional programming. The second and third overall classroom instruction features that were deemed most important were students learn critical thinking skills that lead to solving problems and preparation for college and career readiness skills that will be assessed on new state achievement tests. The participants involved in PBL made up 70% of the students and parents who selected this classroom instruction feature as most important; therefore, it appeared that the development of critical thinking skills was important to those who chose PBL over traditional programming.

The classroom instruction features selected by those who were involved in PBL mirrored the same order as the overall top choices selected by all participants. Those who chose to remain in traditional programming selected preparing the students for competing jobs in the real world as their most important feature, but there was not much distinction between the frequencies of the other choices.

Grading is based on the collaborative efforts of the entire group was selected most often by all PBL and traditional survey participants as the least important classroom feature. The second feature chosen as the least favorite classroom features involved students driving their own learning through inquiry closely followed by students working collaboratively with people with different skills and backgrounds. As the literature reveals, learning through inquiry and with students of different skills and backgrounds are both skills that are very important to the proponents of PBL. It appeared those who completed this survey did not see these skills as having high value as suggested in the research.

When further analyzing the frequency data between all student and parent responses, the three most and least important classroom features mirrored the overall group data. It appeared that students and parents had the same ideas about what was important to them in classrooms whether they experienced PLC or traditional programming. Table 5 displays the results.

Table 5

Responses for Most and Least Value Classroom Features

Value	Students Responses	Parents Responses
Most Valued		
1	Preparation for the real world in which we compete for jobs	Preparation for the real world in which we compete for jobs
2	Motivates the students to take an active role in learning	Work collaboratively with people with different skills and backgrounds
3	Critical thinking skills are learned that lead to solving problems	Preparation for the college and career readiness skills that will be assessed on new state achievement assessments
Least Valued		
1	Grading is based on the collaborative efforts of the entire group	Grading is based on the collaborative efforts of the entire group
2	Work collaboratively with people with different skill and backgrounds	Students drive their own learning through inquiry
3	Students drive their own learning through inquiry	Opportunities to enhance use of technology

A cross tabulation analysis revealed that there was a slight difference between the most important classroom features chosen between PBL parents and students. Although both groups chose preparation for the real world in which we compete for jobs as important, working collaboratively with people with different skills and backgrounds was chosen more often by PBL parents than PBL students. In fact, the PBL students chose that as one least-important features. This is discussed further in the qualitative results.

Program Review. Another part of the survey was provided to those students and parents who participated in the PBL program. All of them at some point had been

involved in the traditional program so they were in a position to compare the two.

Having the participants review the PBL experience helped to understand why this method was chosen by the students and parents and whether students who had initially chosen PBL stayed in PBL programming in subsequent years. It also provided evaluative data to the school to gain an understanding of what the participants' perceptions of the program were so that school leaders were able to make adjustments to programming for the future. Those who took this part of the survey are represented in Table 6.

Table 6

Program Review Participants

Participants	Students	Parents
Male respondents	2	0
Female respondents	14	23

Participants were asked to rate 25 questions in the program review, which were organized into these five constructs prevalent from the PBL research: (a) student achievement, (b) authentic connection to the real world, (c) problem solving and critical thinking, (d) student motivation, and (e) strengths and barriers to implementation. Participants responded using a Likert scale with 4 = Agree, 3 = Somewhat Agree, 2 = Somewhat Disagree, and 1 = Disagree. Each construct included five questions for a total of 25.

A Cronbach's alpha test was utilized to provide internal consistency to see how closely related the items were in the constructs. The alpha coefficient of reliability

suggested the 25 program review survey items had relatively high internal consistency ($\alpha = .951$).

Further analysis is shown in Tables 7 through 11 to display the results organized by each survey construct. The data show the percentage of program review participants for each response using the Likert scale, as well as the mean for each survey question.

Table 7

Participants' Responses to Statements Pertaining to Survey Construct 1: Student Achievement

Survey Question	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Total Responses	Mean
Students learn important knowledge in course content (Biology, computer applications, world history, digital design, and art history).	50.0%	37.5%	7.5%	5.0%	40	3.32
The deep understanding that the teachers want students to demonstrate at the end of the project is clear.	15.0%	50.0%	27.5%	7.5%	40	2.72
PBL classes help all students with different ability levels.	25.0%	22.5%	22.5%	30.0%	40	2.43
Students are prepared to succeed on the new state achievement tests.	12.5%	42.5%	30.0%	15.0%	400	2.53
Students know expectations about how to be successful on assessments.	23.1%	46.2%	23.1%	23.1%	39	2.85

Table 8 revealed 87% of participants who completed this program review section of the survey agreed or somewhat agreed that the important content knowledge of the class was learned by the students in the PBL setting. The results indicated, however, that

30% of participants disagreed that PBL classes helped student of all ability levels. This finding is discussed further in the interview analysis.

Table 8

Participants' Responses to Questions Pertaining to Survey Construct 2: Authentic Connections to the Real World

Survey Question	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Total Responses	Mean
Students build skills such as how to work together with people of different skills and backgrounds	45.0%	42.5%	5.0%	7.5%	40	3.25
Students connect to the real world by asking questions and using resources to develop answers	20.0%	60.0%	15.0%	5.0%	40	2.95
Students show their projects to people outside of their classroom.	15.0%	40.0%	30.0%	15.0%	40	2.55
PBL instruction will prepare students for jobs in the real world	27.5%	42.5%	22.5%	7.5%	40	2.90
Teachers allow the use of technology in the PBL classes	57.5%	32.56%	10.0%	0.0%	40	3.47

The data in Table 9 revealed that when asked about whether PBL provided authentic connection to the real world, 87% of participants reported that they agreed or somewhat agreed with the statement that PBL classes help to build skills leading to learning to work with people of different skills and backgrounds. Also participants (90%) reported that technology was used in PBL classes. The program review participants (45%) revealed that students did not show their projects to people outside their classroom; therefore, this statement received the lowest rating in then construct. These statements were further investigated in the interview portion of this study.

When asked to rate the claim that PBL classes helped students learn how to problem solve and think critically, 92.5% of the participants agree or somewhat agreed that students built problem solving skills during their PBL coursework as reflected in Table 9. However, the ratings trailed off when participants responded specifically if PBL developed critical thinking skills and high-performing teams. Most participants disagreed that students helped decide what they will learn. The interview responses further illuminated the analysis for this construct.

Table 9

Participants' Responses to Statements Pertaining to Survey Construct 3: Problem Solving and Critical Thinking

Survey Question	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Total Responses	Mean
Students involved in PBL build skills in problem solving	27.5%	55.0%	15.0%	2.5%	40	3.08
Students become advanced problem solvers in order to solve problems that have multiple solutions	22.5%	45.0%	30.0%	2.5%	40	2.88
Students help decide what they will learn	22.5%	22.5%	37.5%	17.5%	40	2.50
PBL classes teach students how to think critically to work through challenges	20.5%	35.9%	38.5%	5.1%	39	2.72
PBL classes produce high-performing teams of students	5.0%	35.0%	40.0%	20.0%	40	2.25

In the area of student motivation, Table 10 revealed most participants somewhat agreed that students were motivated in PBL coursework. Eighty-two percent of the responses indicated that students had some choice in projects. Participants agreed or somewhat agreed (total of 61.5%) that the students took an active role in learning, and

66.6% of the participants agreed or somewhat agreed that students used feedback from projects to help them think about their learning.

Table 10

Participants' Responses to Statements Pertaining to Survey Construct 4: Student

Motivation

Survey Question	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Total Responses	Mean
PBL projects focus on an open-ended question that students explore based on their interests	20.5%	41.0%	30.8%	7.7%	39	2.74
Students involved with PBL create projects that generate interest and curiosity	25.6%	35.9%	28.2%	19.3%	39	2.77
Students are allowed to make choices about the products to be created	25.6%	56.4%	10.3%	7.7%	39	3.00
Students are engaged in the projects that motivate them to take an active role in learning	20.5%	41.0%	28.2%	10.3%	39	2.72
Students use feedback to develop skills that help them think about what they are learning	17.9%	48.7%	25.6%	7.7%	39	2.77

The data displayed in Table 11 delved into the common strengths and weaknesses in PBL. Over 65% of the results indicated that processes to communicate all aspects of PBL to parents were not in place. Lack of communication between parents and administrators was discovered in the survey results and became an area of focus during interviews as a result of the survey responses. Over 70% of survey respondents indicated group grading was part of the PBL experience. It is important to note that group grading was reported as the classroom feature that was least important to the students and parents

involved in responding to the survey. The interview portion of this survey will further describe the perceptions of participants surrounding this topic.

Table 11

Participants' Responses to Statements Pertaining to Survey Construct 5: Strengths and Barriers to Implementation

Survey Question	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Total Responses	Mean
Processes are in place to communicate all aspects of PBL to parents	17.5%	17.5%	47.5%	17.5%	40	2.35
The administrators support the PBL classes	42.5%	35.0%	15.0%	15.0%	40	3.12
Teachers are included in quality training in PBL methodology	22.5%	37.5%	25.0%	5.6%	40	2.68
Group grading based on the efforts of the entire group is a part of the PBL framework	35.0%	37.5%	15.0%	12.5%	40	2.95
Teachers coach students through the process giving them enough support to succeed	17.5%	45.0%	32.5%	5.0%	40	2.75

Further analysis was employed to compare the differences between male and female responses. Two survey statements within the survey construct of student achievement revealed differences in the responses based on gender. As indicated in Table 12, there was a significant difference between female and male responses, no matter the age of the respondents, as female respondents rated both of the following statements lower than male respondents:

1. Students are prepared to succeed on the new state achievement tests ($t = 2.46$, $p < 0.5$); and

2. Students know expectations about how to be successful on assessments ($t = 3.02, p < 0.5$).

Table 12

Survey Questions Responses with Statistically Significant Differences Based on Gender

Survey Statement	Gender	N	Mean	Sig.
Students are prepared to succeed on the new state achievement tests	Male	10	3.10	.016
	Female	30	2.33	.014
Students know expectations about how to be successful on assessments.	Male	10	3.50	.005
	Female	30	2.62	.001

To further analyze the data from the program review portion of the survey, mean ranks and sums were compared to understand if differences existed between survey construct responses (see data in Table 13).

Table 13

Mean Rank and Mean Sum Results within each Survey Construct for Program Review

Survey Construct	Mean Rank
Student Achievement	2.79
Authentic Connection to the Real World	3.90
Problem Solving and Critical Thinking	2.36
Student Motivation	3.01
Strengths and Barriers to Implementation	2.94

The construct with the highest mean was authentic connection to the real world, which included questions about collaboration and communication with people of different skills and backgrounds, technology, and preparation for competing for jobs in

the future. The construct with the lowest mean was problem solving and critical thinking, which focused on the development of high performing teams and thinking critically to work through challenging situations to find multiple solutions to complex problems.

To determine if the differences in the mean sums between the constructs were statistically significant, a series of multivariate tests, including Pillia's trace, Wilks' lambda, Hovelling's trace and Roy's largest root were conducted and established that differences between constructs were statistically significant ($p = .001$). A Holm-Bonferroni method test was utilized to make adjustments for multiple comparisons conducted to compare all combinations of survey constructs. Table 14 displays these data.

Table 14

Comparison of Program Review Survey Constructs

Construct	Comparison Construct	Mean Difference	Sig.
Student Achievement	Authentic Connection to the Real World	-1.410	.022
	Problem Solving and Critical Thinking	.385	1.000
	Student Motivation	-.231	1.000
	Strengths and Barriers to Implementation	-.179	1.000
Authentic Connection to the Real World	Student Achievement	1.410	.022
	Problem Solving and Critical Thinking	1.795	.000
	Student Motivation	1.179	.039
	Strengths and Barriers to Implementation	1.231	.111
Problem Solving and Critical Thinking	Student Achievement	-.385	1.000
	Authentic Connection to the Real World	-1.795	.000
	Student Motivation	-.615	.334
	Strengths and Barriers to Implementation	-.564	1.000
Student Motivation	Student Achievement	.231	1.000
	Authentic Connection to the Real World	-1.179	.039
	Problem Solving and Critical Thinking	.615	.334
	Strengths and Barriers to Implementation	.051	1.000
Strengths and Barriers to Implementation	Student Achievement	.179	1.000
	Authentic Connection to the Real World	-1.231	.111
	Problem Solving and Critical Thinking	.564	1.000
	Student Motivation	-.051	1.000

Table 15 displays the survey constructs with significant statistical differences.

These differences are then explored after immediately following the table.

Table 15

Program Review Survey Constructs with Significant Statistical Differences

Survey Constructs	Sig.
Authentic Connection to the Real World and Student Achievement	.022
Problem Solving and Critical Thinking – Authentic Connection to the Real World	.000
Strengths and Barriers to Implementation – Authentic Connection to the Real World	.039

A significant difference was determined as PBL students and parents rated the statements in the student achievement construct lower than in the survey construct that dealt with authentic connection to the real world ($p = .022$). Fifty percent of the program review participants somewhat agreed that the deep understanding that the teacher wanted the students to demonstrate at the end of the project was clear, and 27.5% of participants somewhat disagreed with the statement. Students and parents were not confident that PBL classes helped all students with different ability levels, as 30% disagreed. Also, 30% of students and parents somewhat disagreed if students were prepared to succeed on new state achievement tests.

Another significant difference in results was revealed in the analysis in that the participants rated skills gained in problem solving and critical thinking as much lower than skills gained in authentic connection to the real world ($p = .000$). Participants did not feel that PBL classes produced high performing teams of students as 60% rated this statement as somewhat disagree or disagree. When rating if PBL classes taught students how to think critically to work through challenges, 56.4% agreed or somewhat agreed

and 43.6% somewhat disagreed or disagreed. These results compared to the responses included in the authentic connection to the real world construct differed and are discussed more in the interview results section as I triangulated the data analyzed on these topics.

The last statically significant difference revealed in the data was that strengths and barriers to implementation statement ratings were much lower compared to those in the authentic connection to the real world construct ($p = .039$). Students and parents questioned whether processes were not in place to communicate all aspects of PBL to parents as 65% of participants somewhat disagreed or disagreed. Group grading was based on the efforts of the entire group as acknowledged by 65% of the program review participants. The significant differences discussed surrounding with the perceptions of student and parents were further analyzed in the qualitative and triangulation sections of this chapter.

Survey: Research Question 4. If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why. As mentioned earlier, the quantitative results of this study answer part of the Research Question 4 as only students were examined in the student achievement portion of the research and students and parents were included in the survey. The student achievement data provided assistance in determining which students chose PBL over traditional programming. Students in both programs selected either biology 1 or biology 1 honors tracks. The total group of 221 students included in the student achievement section of this study included 156 students (70.59 %) in biology 1 and 65 students (29.41%) assigned into biology honors coursework. These assignments were scheduled due to past student performance based on grades or standardized testing and student choice. This

data demonstrated that over twice the amount of students were scheduled for the biology programming than the more rigorous honors coursework.

Of those 151 students who chose traditional class programming, 100 students (66.23%) were scheduled into biology 1 and 51 students (33.77%) chose to enroll in biology honors. Of the 70 students who chose PBL programming, 56 students (80 %) were scheduled into biology 1 track and only 14 (20%) chose to enroll in biology 1 honors classes. In conclusion, when determining which students select PBL over traditional settings, the data revealed most students chose traditional biology 1 classes over all other programming. It also appeared that those higher achieving science students were selecting traditional over PBL programming. As discussed earlier, this data revealed more male students selected PBL programming than female students.

Students and parents selected which classroom features were most and least valued. The survey results revealed that PBL participants (48.6%) chose the classroom feature of preparing students for the real world in which they must compete for jobs. This data, compared to 28.6% of traditional programming participants who chose that feature as most important, may suggest a reason for choosing PBL over traditional programming.

Additionally, PBL participants chose development of critical thinking skills that lead to solving problems as another important classroom feature. The participants involved in PBL made up 70% of the students and parents who selected this classroom instruction feature as most important; therefore, it appeared that the development of critical thinking skills was important to those who chose PBL over traditional programming.

It is interesting to note that working collaboratively with people with different skills and backgrounds was chosen more often by PBL parents than PBL students. In fact, the PBL students chose that as one least-important feature. Parents may realize that in the future their students will be working with people from different backgrounds and skill levels. This may be a reason that the PBL parents helped choose this method for their students

To help understand who was choosing PBL over traditional learning, the survey was designed to capture who chose to stay in PBL after their initial enrollment in PBL programming. Of the 19 student responses, six indicated enrollment in two years of PBL and 13 of the student respondents indicated that they were only involved in PBL in their freshman year. Three students indicated that they would enroll in PBL as a junior if classes were offered. The parent results mirrored the student results.

This data suggested that most students who started in PBL as freshman did not stay enrolled in PBL for more than one year and few intended in enrolling in PBL in the future. There were some clues from the quantitative data that revealed the reasons why students and parents choose one type of programming over another. Additionally, the interview data further explains student and parent perceptions about the decision to remain in PBL programming.

Qualitative Results

The qualitative part of this mixed-method research journey helped me explore the perceptions of the participants much more deeply than only analyzing the student achievement data and survey results. I was able to actually hear the participants' words and interact with them to begin to understand their goals, thoughts, and feelings

surrounding both PBL and traditional educational approaches. With the use of interview processes, a deeper understanding of the perceptions of the participants was ascertained which resulted in a richer output than just engaging in quantitative research alone. The interview analyses assisted in better answering the following research questions:

Research Question 2. How do the perceptions of students and parents in the PBL setting compare to the perceptions of students and parents in the traditional setting?

Research Question 3. What are the perceptions of teachers in a traditional setting, teachers in the PBL setting, and with administrators surrounding both learning models?

Research Question 4. If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why?

Interview Population

Student and parent participants were selected by indicating at the end of the survey if they were interested in interviewing with me to discuss their experiences. The interview questions were further developed from the survey results in order to collect more in-depth information. Initially, there were 17 willing families who provided their contact information. I wanted to be sure to include students who had been in the PBL classrooms and those who had chosen to stay in traditional settings. I also wanted to interview students of varied backgrounds and ability levels. After analyzing the quantitative data, I was able to secure four families who met the criteria, for a total of eight interviewees. Two families who chose PBL were interviewed. One was a male, high-achieving student and one was a female, lower-achieving student. Two families

who chose traditional programming were also interviewed. Both were female students who represented high and average achievement. Student achievement level was determined by prior results from standardized tests, course selections, and course grades combined with the self-reporting of the students and parents. All parents interviewed were women. The use of open-ended questions and follow-up questions was employed in order to gain in-depth responses.

Three female teachers and one male teacher and one female administrator and one male administrator involved with both the PBL and traditional approach to classroom settings were also interviewed. The interview protocol was different for each group of participants, but within each group some of the questions were the same so that comparisons could be made.

A specific process (Roberts, 2010; Tesch, 1990) for analyzing interview transcripts was followed. First, the transcripts were read to get a sense of the whole experience. The interview data were reviewed several times to open code or summarize what was being reported. This was not based on existing theory, but truly what data emerged from the data collected. After reviewing each interview transcript, a preliminary list of categories that emerged from the interviews was developed. Each theme was given an initial coding by using the most descriptive wording.

The responses were organized by the following groups: PBL student, traditional student, PBL parent, traditional parent, teacher, and administrator. The comments were then divided into three categories—positive, negative and neutral—for each research question based on the above-mentioned respondents. A master-coding list was then organized by frequency. Using the master-coding list, the full transcript of each

participant was developed into the final axial coding. Further analysis of each interview transcript was conducted, and themes, patterns, and categories for each of the research questions were developed. The data were then selectively coded in a way that related to the identified categories. Finally, I reviewed the total transcript to ascertain the validity of findings by triangulation of data. These data are presented in Table 16.

Table 16

Open Coding Relating to Interview Questions

Data/Data Code	Students	Parents	Total Students and Parents	Teachers	Administrators	Total Teachers and Administrators	Total Comments
Student Learner Style(Lecture vs Active Learning)/SLS	16	26	42	7	10	17	59
Student Ability Level/SAL	15	15	30	7	10	17	47
High/SALH	7	6	13	4	4	8	21
Middle/SALM	6	3	9	1	4	5	14
Low/SALL	4	6	10	2	2	4	15
Technology Usage/TE	12	13	26	5	1	6	31
Engagement/E	12	12	24	3	4	7	31
Prepare for college and career/CC	12	24	40	4	4	8	44
Collaborate with Peers/CP	11	20	32	14	9	23	54
Scheduling and Credit Obtained/Sch	6	16	22	5	9	14	36
Group Grading/GG	6	7	13	4	3	7	20
Communication /CM	4	12	16	6	5	11	27
Commitment of Staff/SC	9	13	19	6	12	18	40
Involvement of Parents/PI	13	18	31	5	9	14	45
Training of Staff/ST	9	10	19	3	6	9	28
Administrative Leadership/AL	6	12	18	6	4	10	28
Expectations (known vs unknown)/EX	16	16	32	8	7	15	47
Blending of class objectives obtained/OB	9	8	17	15	11	26	43
Implementation Strengths or Barriers/ISB	7	8	15	10	12	18	31
Valid Assessment Design Used/VA	6	3	9	11	6	17	26
Follow Friends/FF	4	0	4	1	3	4	8
Parents Decision/PD	3	4	7	0	0	0	7
Leader in classroom/CL	0	4	4	0	0	0	4
Grades/GR	5	14	29	0	0	0	19
Total Coded Interview Comments	179	255		120	125		672

It is worth noting that parents were more forthcoming in providing detailed comments than their students during the interviews, despite continued probing. Also, administrators logged more comments than teachers in total even though only two administrators were interviewed compared to four teachers.

Qualitative Analysis by Axial Coding. To transition from open to axial coding, I reread the transcribed interviews for specific patterns of statements that could be related. I grouped the open-coded statements into fewer categories that lead to richer analysis. After further analysis with student and parent interview transcripts, patterns began to emerge. The results are organized by research questions to mirror the organization in the quantitative results section. Figures 1 and 2 include comments supporting the 10 major themes coded from interview questions for parents and students. These comments help answer Research Question 2. Figures 3 and 4 include comments by teachers and administrators, which assisted in answering Research Question 3. A summary of findings follows each figure. Next, exemplars were used as representation of the overall major themes discovered in the study to answer Research Question 4, in reference to which participants were selected and interview results that allowed for triangulation, which is important in mixed-methods research.

Research Question 2. How do the perceptions of students and parents in the PBL setting compare to the perceptions of student and parents in the traditional setting? Major themes, which served as evidence of the perceptions of students and parents in traditional settings, are displayed in Figure 1 followed by the perceptions of students and parents in PBL, which are displayed in Figure 2.

Major Themes	Students	Parents
Student Learner Style (lecture vs. hands on)	“I feel like I learn best with lectures, not really PBL type learning. I retain things better when I hear them rather than do more hands-on things.”	“If it isn’t broken, don’t fix it.” “The biggest thing against PBL was group learning but it’s not the only method to teacher and it’s not for every learner.”
Prepare for College and Career	“When I get into my AP classes, I try my hardest all the time. I want to get good grades and get into a good college.”	“I have experienced PBL in graduate school. It was really hard. If someone shows up without their work done, the entire team suffers. In the work place, you are not sharing a grade. If that person isn’t pulling their weight then they may no longer work there. That was what one of the concerns was, okay, so are we diluting education so that Johnny C- Average is going to be okay at the expense of Annie A- Average.”
Collaborate with Peers	“We would work on some stuff together by everyone was at a different spot. I wasn’t bored having to stay with the other kids I was ahead of as an advanced student, I usually get stuck with the majority of the work, and I could’ve just done it by myself without sticking someone else’s name on it when I’ve done it.”	“That was one of our biggest concerns that our kids would be in a group where they feel like they had to do all of the work and then they shared the credit.”
Expectations (known vs. unknown)	“I know I’ve done well in school so I figured I’d stay and I felt like I can get more the traditional learning more than the PBL.”	“I have a negative perception because I had two kids who had done through traditional and seemed to do well.”
Involvement of Parents	“I remember that a lot of parents being mad about it. They has a lot of us school board meetings and things, I think I went to a couple actually.”	“We were a group of parents that started that asked to meet with administrators and then we became the helicopter parents who – we heard that’s what they called us because we were the parents who asked questions and go involved. Then that became a thing too. It was like, “We’re educators, and we know better than you do. You’re just parents,” that kind of thing.”
Student Ability Level	“I am probably more of a high-achieving student. I’ve always been more motivated to work in school, so I take AP classes and things like that.”	“I think the most important thing is that classroom-let discussions are definitely geared at their level. If the teacher makes her feel comfortable and confident in her abilities, she will excel in those classes.” “And most of the people in that group were people that had the kids that were smart. I don’t know how else to say it –who were higher achievers.”
Grades	“I think that probably would be the number one issue, just people not being on the same page, one person doing more work than the other people and then sometimes you get the same grade, which is not a good thing.”	“If everyone is sharing a grade, the kids that do work really hard and do care about their grades are going to do the project. It is important that out get different prospective but the bottom line is the kids that want the grades are the ones that are going to get it done.”

Technology Usage	“I think actually a lot of them (PBL Students) were just excited that they got tablets. That was like the big reason that they were doing it”	“Even the kids at school were saying, “Well, were are getting a tablet and you are not.” Some parents thought that we are never going to be able to afford a tablet so at least my kid’s going to get some access to technology.”
Engagement	“They make it real fun and just have a whole lot of stuff for us. He always had a story to go along with anything that he was teaching us, so I think that helped stick in my mind better.” “I think the type of student that would probably do well in PBL would be someone who probably does like hands-on learning and is attracted more to technology, probably, like, in their free-time. Maybe it would get them more interested in learning if they knew there was some technology aspect to it.”	“Collaborative learning, there is a benefit to it We have to collaborate all our lives. Here’s the one thing I will say about PBL in particular. It seems like it was so directed and so collaborative that here’s what the teacher was told that they had to teach. Here are the instructions for doing the project, and here I am going to be at my desk. So there wasn’t as much teacher involvement as other classes. It was awful.”
Scheduling and Credit Obtainment	“I know people who took PBL and they were drawn to it because of the credits they could get, the double whammy credits.”	“It was like if you wanted the Honors diploma you had to do these certain things your freshman year, your sophomore year, and your junior year. It was very rigorous.” The pairings didn’t make any sense to me. “I didn’t understand what they were trying to accomplish. I didn’t spend a lot of time on it because it didn’t fit into our schedule of classes.”

Figure 1. Comments Supporting Major Themes and Coding of Data from Traditional

Student and Parent Interview Questions

Major Themes	Students	Parents
Student Learner Style (lecture vs. hands on)	“I like hands-on learning. I like classes that make things fun.”	“She’s never really ever likes school, so we thought maybe this is something that will get her motivated. Why not try it?”
Prepare for College and Career	“Mainly we thought it would help me in my schooling and my understanding, because a lot of colleges do day they’re heavily based on projects, and that’s how you get your experience.”	“He has more ability to control emotions, common sense and has that business person about him, public speaking and that can carry you pretty far.” “I think PBL was the most real world choice. It was a good choice. I think there was excitement the first year.”
Collaborate with Peers	“First semester had some clique clashes and got along better with second semester group because we got to pick and those were my friends.	“There was a system in place where you could write little reports about the students in your group and you could go to the teacher and then after three

	<p>First semester was also the division of work. I was the main person and had to tell people to research things so that I did not have to do all of the work. When we got to choose our groups second semester, I did not have that trouble because I did have people in my group that actually put effort forward towards the projects.”</p>	<p>or four warnings they would get kicked out of the group and would have to do their own project. Students could also just say to the person, “I don’t feel like you’re carrying you own weight. The kids in there did a really good job regulating that.</p>
<p>Expectations (known vs. unknown)</p>	<p>“I do want to own my own photography studio so I thought maybe this would help with at least managing files and doing all of that kind to thing.” “I think the teachers made it worse. It was the whole lack of communication with the teachers was the biggest issue for me. There didn’t seem to be any communication between them, and if there was, there wasn’t a lot shown in their lesson plans.”</p>	<p>“I just feel that maybe it did not go the way they planned on it going, and the technology wasn’t where they thought it was when they started. Maybe they felt like “Oh, we should have waited another year.” So instead of encouraging those teachers to get through the year, they backed off and were like “We don’t want our hands on this.”</p>
<p>Involvement of Parents</p>	<p>“Every student was going to be included in PBL until parents got mad about it.”</p>	<p>“By the time we finished with the committee there were very few parents that stayed with it. There was only 4 or 5 set of parents that stuck with the meetings.”</p>
<p>Student Ability Level</p>	<p>“I like to put myself somewhere between the low achiever and the average achiever.”</p>	<p>“He is a very good student and he does not give himself credit for the fact that he is a very good student. He is a very good test taker. He got a 1720 on the SAT and only got a 3 on his GPA.”</p>
<p>Grades</p>	<p>“Sometimes I felt that I did all of the work and everyone got the same grade.”</p>	<p>“Parents were concerned that projects were all group grades and oh well my son is doing all of the work.”</p>
<p>Technology Usage</p>	<p>“We got tablets but they didn’t work out like they thought it was going to. I felt the tablets had a lot of problems with them that they didn’t expect. We couldn’t use them as much. We were using laptop carts that the teacher would bring in more than the tablets. I thought I’d go in there and get not only the tablet experience, but actually going on into a computer lab and doing spreadsheets and doing things like that, but we never went out</p>	<p>“It was pretty frustrating. The pad they got weren’t set up appropriately. Some information wasn’t even on there. Some of her friends knew more about it than the teachers.”</p>

	<p>of that classroom unless it was to print something off. I learned more of the biology side than the technology side.”</p> <p>“I had more access to technology in my traditional classes than my PBL classes.</p>	
Engagement	<p>“I’d say probably one-half to two-thirds of the students in my class took freshman year Biotech. Then ANDE there weren’t that many kids in there. It really dropped off from freshman to sophomore with how many kids took it.”</p> <p>“I like classes that make things fun. I don’t like teachers who are indifferent about their jobs or they are just there for the paycheck and not there for the kids anymore. What gets to me is you’re here to teach the future generations. We’re going to end up taking care of you at some point. Teach us how to do that and not just act like you’re just there for the paycheck.”</p>	<p>“I knew art was totally not his thing, but history totally is his thing. I know most of the history classes there he would probably fly through and take all of them So I thought maybe this would be a different angle or twist for him.”</p> <p>“She likes the projects she did. She liked that whole aspect of it.”</p>
Scheduling and Credit Obtainment	<p>“We only got two. I thought it was going to be 3 credits for 2 periods, but the first semester it was World History and Art History. Second semester it was World History and Digital Design. I thought it was going to be two semesters of all three at the same time.”</p>	<p>“I didn’t see the teachers as team teaching. There was two different class with two different teachers that sometimes came together to put the project together.”</p>

Figure 2. Comments Supporting Most Common Concepts and Coding of Data from PBL Student and Parent Interview Questions

The interview responses of the students and parents who were involved in traditional class programming suggested that families wanted to continue participating in the traditional methodology because they knew what the expectations were and the students had been successful in the traditional classes. The data also suggested that the

students and parents were concerned about collaboration with peers. This concern comes from a perception that high achieving students do all the work and receive the same grade as those who may not have contributed as much to the team. It was noted by most of the participants that technology was promised to the PBL students in an effort to get students to participate. The parents suggested that the communication about PBL was not effective and that their concerns were not considered. Parents stated that they did not trust the administration and questioned the motives of bringing PBL to the school. Most of the students and parents mentioned scheduling as being a concern for taking anything but traditional courses and staying on track from the freshman year throughout the senior year.

The interview results suggested that students and parents who chose the PBL programming were looking for a different delivery of instruction than provided in most traditional classrooms. Learning styles of the students were mentioned most often by the participants as desiring hands-on learning and less lecturing by teachers. Student engagement was important to all PBL participants. All participants believed that PBL would help them learn how to collaborate with their peers and mirror the real world. They hoped to learn technology skills that would be used in their college work and careers. It was interesting to note that no student in PBL mentioned grades as an issue. Scheduling and credit obtainment were also important to the students and parents. Longer class periods and higher credit obtainment due to blended class design was promoted to the participants of PBL.

Several comparisons were made between the perceptions of students and parents in PBL to those of student and parents in the traditional setting. First, the students and

parents in the traditional setting knew the expectations of the traditional classes and felt their children had been successful in their current courses. The PBL students and parents were looking for another way of learning that focused on student engagement and motivation. Second, traditional students and parents were concerned that collaborating with peers would turn into group grading and only some students doing all the work. PBL students and parents reported that they believed collaboration with peers would mirror real world experiences and group grading was not a concern. Next, all participants mentioned the use of technology; however, their perceptions were much different. The traditional students and parents felt that it was used as a way to get students to sign up for PBL and the PBL participants clearly wanted to learn more about technology and use it in their coursework. All participants mentioned scheduling concerns as an obstacle in truly making choices about which methodology would work best for them. Last, during the interview process, neither traditional nor PBL participants made any mention of students learning through inquiry. Perhaps the interview questions did not lend themselves to exploring this classroom feature.

Research Question 3. What are the perceptions of teachers in a traditional setting, teachers in the PBL setting, and with administrators surrounding both learning models? The major themes, which served as evidence of the perceptions of teachers and administrators, are displayed in Figure 3. As was explained earlier, the teachers were in a position to compare the two methodologies because that had participated in both the traditional and the PBL models. Administrators were in a similar position since they had led the building while both models were being implemented.

Major Themes	Teachers	Administrators
<p>Blending of Class Objectives and Scheduling</p>	<p>“I had challenges covering my technology standards because the other course, biology was a core subject. All of our projects were driven by the biology standards because, sorry it is just the way the school operates.” “It is hard to get the timing for a completion of a unit in terms of I’m supposed to stay on track with the regular world history class.” Then there were too many (students) and so some got taken away but the others might not have even chosen it for themselves. They just got pushed in it.” “I’ve heard so-so things with the PBL from the freshman because some of them were forced into it and all, I’m not sure.” “We had a whole, big array of achievers, not-achievers, higher learners, and gifted or special learners and so that was hard in trying to get the balance and then there were ones who would never do anything.”</p>	<p>“Scheduling – “I think the frustration came in when scheduling became more difficult which go in the way of collaboration when we had to work around which teacher was teaching a PBL course.” “Unfortunately, we have a lot of kids that are put in there who, for whatever scheduling reasons, were put in here.”</p>
<p>Collaboration with Peers</p>	<p>“We would have really good groups and really bad groups. I hate to say it. We got good at distributing high-performing people with the low-performing ones. Sometimes I felt like that wasn’t fair. We had a couple of low-performing teams because, to be honest, sometimes you had your three or four that just don’t want to do anything. Sometimes we said, You know, I would like to just group them together, but then that defeats the whole purpose because he should be infiltrated with a group that; is going to drag him in, bring him in and it was fun to see.”</p>	<p>“I think the skills that they honed in on and developed through the process probably in the long run are going to be the more beneficial experience for the student over the rest of their high school and their college or work situations.” “We actually intentionally made a common prep time for the teachers, but I was not present during those times to see if they collaborated.” “The kids that knew the expectations were going to be different steered clear.” “Kids who had strength in performing were the ones choosing it, such as kids in band.”</p>

	<p>“One of the major complaints that we got from students who had taken a precious PBL class was they did not like staying in the same group for the entire year. So we tried to mix things up a little bit with mixed abilities together in groups.”</p>	
Commitment of Staff	<p>“And it’s been hard learning how to work with another teacher but we’ve finally learned how to do it, and so as soon as we’re starting to really sync, it’s coming to a stop.” “Then for us, we had done all this work and then it fizzled out just when we were getting really good and having our resources build up.”</p>	<p>“PBL was the vision of one person.”</p>
Parent Communication	<p>“It was awful. It was awful here because the parents were in an uproar about it in the way it was presented. It was presented that it was going to be mandated, and I understand that some were fearful. To be honest with you, it was a bad group of parents to start with just because they just pushed back and then it just wasn’t presented well.</p>	<p>“Parents were confused as to why all of a sudden that we were forcing them into something that was kind of new and just out there a little bit. So there was concern.” “Initially every student was going to be in a PBL class for Biotech, but there was some resistance from the community, forming their own research and own opinions and communicating that, which led to it being an option only.”</p>

Figure 3. *Comments Supporting Most Common Comments and Coding of Data from Teacher and Administrator Interview Questions*

The interview responses revealed that the implementation of PBL had many challenges. The blending of classes was seen as difficult by many of the participants. The data suggested that teachers had a hard time maintaining a proper balance between the two or three subjects that were combined. Along with this issue, educators stated that scheduling issues were another challenge. Most reported that students were pushed into PBL due to the constraints of scheduling and not by choice.

The survey results suggested that students and parents did not feel that high-performing teams of students were developed. Therefore, this concept was included as an interview question for teachers and administrators. The interview results revealed that high performing student teams were not developed because the difficulties of collaboration with peers within groups and classes proved to be more challenging than many teachers originally thought. The teachers were accustomed to having classes with ability-grouped students and PBL classes were comprised of a mix of students with different abilities.

The most prevalent issue brought forward by both teachers and administrators during interviews surrounded the topic of the commitment of the staff. Teachers and administrators stated the idea of PBL was the vision of one administrator and a few teachers, some of who were no longer at the school. Teachers mentioned a lack of training and resources as an issue with PBL implementation, which ultimately impacted staff commitment to PBL. However, a few teachers were disappointed that the offering of PBL was eliminated. They expressed they had worked through many of the challenges with the implementation phase of the program and were making continue adjustments and improvements. They would have liked the opportunity to continue refining the PBL initiative.

Parent perceptions were another barrier educators mentioned most often. Educators believed that parents had not been communicated with as well as they needed to be before PBL programming was offered. Originally, PBL was not going to be offered as a choice, but the entire student body was going to participate in PBL in some portion of their day. The school corporation had obtained grant funding to begin PBL and the

time to implement the program to meet the grant requirements was a very short window. Because many parents felt this was being forced on every student without proper parental input, several families were upset. A traditional parent clearly expressed this theme.

I felt along with some other parents, that this was a new thing, the new teaching method that we were hearing about was sneaking up on us. I felt like it was propaganda that we being sold. I think it was being shoved down our throats.

This is a done deal.

During the interview a teacher clearly explained the overall feelings.

Most of the attention to the initiative, from parents' perspectives, surrounded group grading and the majority of group work being done by higher-achieving students. Many students and parents displayed their resistance to every student being required to participate in PBL programming during several board meetings. As a result a committee of parents was created, but after the decision to make PBL programming a choice, participation in that committee trailed off quickly. Teachers believed that that parents did not understand the benefits of PBL for students and that there was a negative connotation surrounding PBL before the coursework even started.

Research Question 4. If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why? To answer this research question from the qualitative data, I went to the participants' actual words. The students and parents who chose PBL over traditional classes mentioned student-learning style as one of reasons they made their choice. Comments from one student and two parents representing this idea included:

Because of the projects and stuff, I usually do better on those, so I thought I would do better. I do well on tests. I just don't like to do my homework. I don't know why I have to do that if I know the material. (PBL student)

I thought it would be something that he would like because he is a hands-on kid. He wasn't one that would sit down and just go over it and memorize. He learned more when he had fun. I know he had some great teachers along the way that encouraged creativeness and that was very good for him and put his own little twist on it. I could see the excitement in him. (PBL Parents)

Another reason students and parents chose PBL over traditional learning was that they thought it would help them in the college and careers especially in learning how to work with different people with varying skill levels and backgrounds. As one student and parents explained, "We thought maybe it was a good idea for maybe some sort of college experience" (PBL Student).

Back to the life experiences, it did, it taught them how to work with groups of people and it taught them how to organize their thoughts and how to, because it was real world, if you have it like this, what you're doing, you have to figure out how to organize your thoughts and how to get it together and how to research it and then to present it. (PBL Parent)

Another interest in the PBL experience surrounded the use of engagement through the use of technology. Students made the choice to try PBL because they thought that they would be able to use more technology than what they had used in their traditional classes. This idea is best shown with the following student's statement, "I had more interest in the

tech part than the science part, because this is our day and age. We have a lot of technology and a lot of businesses heavily put their trust into technology” (PBL Student).

Students and parents also choose PBL because it was supposed to accomplish obtaining course credits more efficiently over traditional class structures. As one student explained, “For ANDE, we were originally told we were going to get three credits during two-class periods, so that’s why I took that class. When I got there, we didn’t.”

These words exemplify why some students and parents made the choice to become involved with PBL. It should be noted that students and parents were in agreement, which suggested that students’ opinions might have been swayed by their parents. “I knew my mom was on that committee, so I asked her about it. She thought it was worth taking, so I tried it” (PBL Student).

Teachers and administrators gave a few reasons which students were choosing PBL and why they made that choice. Answers centered on students who had scheduling issues, those who wanted something different, and those who enjoyed the performing arts, such as band students. Several educators mentioned the students remaining in the traditional programming did so because they knew the expectations for those classes. Surprisingly, only one participant, the new administrator who had not been there at the inception of PBL, mentioned that students chose PBL over traditional classes based on what their friends were choosing.

Three teachers (and no administrators) commented on why they had chosen to become a PBL instructor. The following comments are examples that show how some felt about choosing PBL over traditional classes. “Objectives of courses were so far apart

that it was hard to blend courses together, for instance biology with computer applications. Teachers were just kind of thrown together” (PBL Teacher).

I just said I would do it until my principal’s happy. I’ll be honest; we’ve been through two principals since. So that’s another thing. I think it was a new principal, a new idea, a new concept and sometime there’s going to be backlash with that. (PBL Teacher)

“This was kind of forced so there wasn’t a commitment from teachers” (PBL Teacher).

After careful reflection, it may have been that the interview questions did not specifically ask enough information to illicit responses that answered why teachers and administrators chose to become involved in PBL. I should have asked more open-ended questions such as, “Why would you have wanted to continue PBL?”

Triangulation: Comparing the Quantitative and Qualitative Data Analysis

Throughout this study, the quantitative work guided my qualitative research. The 14 interviews conducted with students, parents, teachers and administrators were transcribed and coded through open and axial coding processes. Assigning codes in this manner helped determine themes and patterns about perceptions of PBL and traditional programming. Now that all results have been presented, it is important to discuss the relationship between the quantitative and qualitative portions of the study. Research Questions 2 and 4 were examined in both research methods and results for this section are also organized by research questions.

Research Question 2. How do the perceptions of students and parents in the PBL setting compare to the perceptions of student and parents in the traditional setting? In the most and least valued classroom feature section of the survey, parents (both PBL

and traditional combined) did not rate the development of critical thinking skills as either most or least important. The students (both PBL and traditional combined) did select it as their third highest most important classroom feature. During the program review section of the survey, PBL students and parents were asked to rate the claim that PBL classes helped students learn how to problem solve and think critically and 43.6% of responders somewhat disagreed or disagreed that these skills were developed in the PBL programming. The interview data supports this idea, as there were no interview comments that supported PBL assisted in students learning how to think critically to work through challenges. However, students did choose that they valued learning critical thinking skills that lead to solving problems. It should be noted that it is possible that the interview questions posed to students and parents did not specifically invite those comments into the responses.

PBL parents indicated in the classroom feature most and least valued section of the survey that they wanted their students to build skills in how to work together with people of different skills and backgrounds. On that portion of the survey, PBL students chose that statement as a least important classroom feature. However, program review survey results revealed that 87.5% of PBL participants (both parents and students) agreed or somewhat agreed that in PBL programming students did learn how to work together with people of different skills and backgrounds.

A disconnect existed between what parents said they wanted for their students in the survey compared to comments made from participants in the smaller group who participated in the interviews. During the interview process, it was revealed 50% of the participants agreed working with students of differencing ability levels was problematic.

Parents and students spoke out against this during the interviews citing that group grading was unfair and the group structure perpetuated the idea that higher achieving students completed most of the work for the entire group. This data suggest that perhaps learning how to work with people of different skills and backgrounds is important, but actually learning how to do it in the classroom may be a challenge.

Grading is based on the collaborative efforts of the entire group was selected most often by all PBL and traditional survey participants as the least important classroom feature. In the program review, 72.5 % of the participants agreed or somewhat agreed that group grading was a part of the PBL process. The interview results revealed that all interviewees reported that group grading was an unfavorable result of PBL programming. One PBL parent explained,

She did seem to carry a lot of the projects, do the majority of the work. She was getting more graded on the group instead of her individual work and the individual work we thought was more of an A but she'd end up with a C on the project because it was a group effort. And student C wasn't doing their share.

She would try to pick up that slack, but that's not her responsibility. (PBL Parent)

The results were also similar in that high-performing teams were not developed as the survey results indicated that 40% of participants agreed or somewhat agreed that these teams were developed in the PBL experience. The interview results from students, parents and educators triangulated this data as all participant groups reported that the balance of group work among team members was challenging. Teachers also commented most often on how difficult it was to bring students of different skills together to work on a common project. An example of this is included below.

I feel that having all high-performing teams was the one area that's most difficult for us. I feel like you have high- achievers and the high achiever will get invested in the learning. We have some students who cannot move from A to B without guidance. It is the high achievers that get the most out of it. (PBL Teacher)

One of the classroom features that was chosen by both students and parents (PBL and traditional combined) as least valued was that students drove their own learning through inquiry. The program review survey results show that 55% of PBL participants somewhat disagreed or disagree that students were able to decide what they would learn. Additionally, there were no positive comments of this in the interviews. In fact, the perception of traditional parents is represented by this one comment.

Here's the one thing I will say about PBL in particular. It seems like it was so directed and so collaborative that here's what the teacher was told that they had to teach. Here are the instructions for doing the project, and here I am going to be at my desk. So there wasn't as much teacher involvement as other classes. It was awful. (Traditional Parent)

Research Question 4. If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why? As mentioned in the quantitative part of this study, when determining which students are selecting PBL over traditional settings the results revealed those higher achieving science students were selecting traditional over PBL programming. The interview results provided triangulation of this data as the responses indicated that was the perception of all the students (100%) interviewed, most of the parents (75%) interviewed and, most of the teachers (75%) interviewed.

The survey results also revealed that participation in PBL fell dramatically over a three-year period of time. Comments during the interviews from students and parents and supported this idea and perhaps provided reasons for the decline in PBL. Two examples demonstrating this follows.

The kids taking PBL dramatically fell off the second year. The flow that year wasn't as good. I think it was the class subject mixture. There wasn't near the excitement within the 2nd year. He would say, "This is just a pain. It's a waste of my day. I'm tired." (PBL Parent)

"I didn't see the teachers as team teaching. There were two different classes with two different teachers that sometimes came together to put the project together." (PBL Parent)

Teachers also suggested some reasons for the decline in participation of PBL. Lack of training and resources was mentioned most often. One administrator commented on specific training. The PBL teacher's comments represent the feeling of several teachers. "The teachers with the most training, such as business and biology were better than our history and art teachers because they received more training." (PBL Administrator)

Resources are fairly limited for people who are close to come in to speak to the kids or we don't have a project manager to help coordinate contacts and so that is a challenge. We are defiantly falling short on reaching out to community members. (PBL Teacher)

The administrator who came after PBL was started gave the reasons why the students, parents and teachers did not continue to choose PBL over the years. He said,

When I began asking questions about why we were doing PBL it came back to that it was the direction or passion of one person and there wasn't a lot of wholesale buy-in. Because of changing in staffing and lack of student participation, we had to dismantle it. (PBL Administrator)

Summary

The mixed-method approach to the research analyses attempted to answer questions surrounding student achievement, perceptions of participants, and why some students, parents, and educators were choosing PBL over traditional programming. There were four major findings of this study. First, the analysis of the data suggests that there is no significant statistical difference between the two groups' results and there is no evidence to support PBL increased student achievement. Second, preparation for the real world in which students compete for jobs was important to students and parents in both programs; however, perceptions varied about which type of programming led to this success. Third, educators agreed there were far more barriers than strengths to the implementation of PBL as the vision was embraced by few, had little staff buy-in, and lacked quality training. Last, students and parents who selected PBL were in search of a different approach to learning that focused on student learning styles, embraced technology, and prepared students for college and career readiness in working with people of different backgrounds and abilities. In Chapter 5, I will draw conclusions about the results, relate the results to the literature, and suggest future recommendations and further research.

CHAPTER 5: CONCLUSIONS

This chapter includes: (a) a summary of the study, (b) major findings of the study organized by research questions, (c) findings related to the literature, (d) implications for educational leaders, and (e) recommendations for further research.

Purpose of the Study

The purpose of this study was to examine the perceived differences between a PBL classroom and those of a more traditional classroom. Another purpose of this study was to discover which students, parents, and teachers chose PBL over the more traditional setting and why they made that choice. Student achievement results of both methodologies were examined, and stakeholders' perceptions surrounding PBL were collected, analyzed, and interpreted. The goal was to contribute participants' perspectives for the benefit of scholars, administration, teachers, parents, and students. The study also served to provide program evaluation data to the school's leaders to guide future decision-making regarding PBL in the school and district.

Research Questions

Quantitative and qualitative data were collected in order to respond to the following research questions:

- In a suburban high school giving the students the choice to engage in PBL, what effect does PBL have on student achievement?
- How do the perceptions of students and parents in the PBL setting compare to the perceptions of students and parents in the traditional setting?
- What are the perceptions of teachers in a traditional setting, teachers in the

PBL setting, and with administrators surrounding both learning models?

- If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why?

Review of Research Methods

My research was designed as a mixed-methods study. The quantitative portion of the study was designed, in part, to help understand whether participation in PBL had an impact on student achievement as compared to the achievement for those students choosing traditional programming. For this analysis, I created two comparison groups with matching demographics based on gender, social economic status, and pre-test scores on the state standardized tests. I then compared End-of-Course Assessment post-test scores between those who participated in PBL and those who participated in traditional Biology programming.

I developed a survey based on the claims of PBL proponents found in the literature. The survey was offered to all students and parents who were involved in making the choice between the PBL classes and traditional classes. The survey attempted to capture which features of classroom instruction were most and least valued by students and parents. The features of classroom instruction included were (a) work collaboratively with people with different skills and backgrounds, (b) engaging instruction that motivates the students to take an active role in learning, (c) opportunities to enhance the use of technology, (d) preparation for the real world in which we compete for jobs, and (e) preparation for college and career readiness skills that will be assessed on the new state achievement test.

An additional part of the survey gathered information from the students and parents who chose PBL as part of a program review for the district. The applicable participants were asked to rate their experiences with PBL. Using information from my literature review, I intentionally clustered the survey questions into five related sections. These constructs enabled me to determine if some features of PBL were more or less valued by the families who chose PLB. The clustering of constructs also expedited data analysis. The survey was distributed at the end of the students' sophomore year and indicated whether or not the students chose to enroll in PBL in the future, and why they made their decision. These data were critical to understand why some participants chose traditional or PBL settings, which is at the heart of my study.

The qualitative portion of this study involved students and parents who provided their contact information at the end of the survey if they were interested in participating in the interviews. I was able to secure four sets of students and parents who agreed to interview with me. Two families that chose PBL were interviewed. One was a male, high-achieving student and one was a female, lower-achieving student. Two families that chose traditional programming were also interviewed. Both were females who represented high and average achievement. Their participation in these interviews enabled me to glean a better understanding of the reasons students and parents chose either PBL or traditional programming and provided a window to peer into their perceptions of each.

Additionally, I interviewed four teachers and two administrators who had been involved in delivering instruction in the integrated PBL courses. The development of the interview protocol for teachers and administrators revolved around the necessary

components of PBL implementation as identified from Thomas Markham's work (Markham, 2011; Appendix C). The interviews assisted in understanding the educators' perceptions surrounding both PBL and traditional learning models.

All interviews were recorded and transcribed. All transcripts were read first to get a sense of the whole experience. Field notes and memos were examined and analysed on each of the transcripts, and patterns and themes emerged. I then reread the transcribed interviews and reviewed the data from the interviews that related to the quantitative part of this research study. The triangulation of the data provided the richness in the mixed-method approach. Last, responses to the four research questions of the study were ascertained.

Major Findings

Research Question 1: In a suburban high school giving the student the choice to engage in PBL, what effect does PBL have on student achievement? The analysis of the data suggests that there is no significant statistical difference between the two groups' results and there is no evidence to support that PBL increased student achievement. Standardized test scores were used to measure achievement in this study, which is a common method of trying to assess student achievement in US schools.

Research Question 2: How do the perceptions of students and parents in the PBL setting compare to the perceptions of student and parents in the traditional setting? Preparation for the real world in which students compete for jobs was important to students and parents in both programs; however perceptions varied about which type of programming led to this success. The traditional students and parents indicated that obtaining good grades and consequently a high GPA would lead to getting into a good

college and eventually a successful career.

Parents of high-ability students expressed concern about their students working with students of lower ability. They had the idea that the lower achieving, less motivated students would hold back their higher achieving, motivated students. Students and parents expressed concern surrounding the practice of group grading. They worried that a few students would do all the work and everyone in the group would receive the same grade. This was tied back to possibly achieving lower classroom grades resulting in a lower cumulative GPA, which may keep their students from competing for quality colleges.

Students and parents who chose to engage in PBL were in search of a different approach to learning which motivated students by offering more engaging classroom structures and focusing on development of 21st century learning skills. They suggested development of these skills would lead to future success in college and careers.

Research Question 3: What are the perceptions of teachers in a traditional setting, teachers in the PBL setting, and with administrators surrounding both learning models?

Educators agreed there was far more barriers than strengths to the implementation of PBL as few embraced the vision, had little staff buy-in, and few participated in quality training. The overall perception of the teachers was that the PBL vision was the vision of one administrator and embraced by few staff members. The principal, counselor, and one of the very involved teachers in the district were the first adopters of PBL, who subsequently left the corporation during the course of this study. The current principal was not there for the inception of the program and discovered that the teacher buy-in was

low, as most teachers could not give the reasons for the implementation of PBL. Teachers in PBL, in some situations, did not collaborate as much as needed for implementation to go smoothly and there was a lack of ongoing, job-embedded professional development. Because of poor implementation of PBL the first year, the participation dropped off for the second and third years. The third year the PBL opportunity completely faded away.

Research Question 4: If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why. Students and parents who chose PBL were in search of a different approach to learning that focused on student learning styles, embraced technology, and fostered college and career readiness in working with people of different backgrounds and abilities. Students were swayed in their decision making by what their parents' perceptions were as evidenced during the interviews. Scheduling of student course work was often the deciding factor of whether students enrolled in PBL or traditional programming. If the blended courses worked into the students' schedules better than the traditional classes, students were scheduled into the PBL courses. On the other hand, if students had courses planned for several years in advance, they chose traditional classes to maintain the original plan. Some students also chose traditional programming because they knew what to expect and how to earn good grades.

Findings Specific to the Literature

Chapter 5 focuses on a more in-depth discussion of the findings in Chapter 4. This discussion centers on how my results relate to the research from the literature review in Chapter 2. As in previous chapters, the findings are organized by research questions.

The last sections include implications for action and recommendations for continued research.

Research Question 1: In a suburban high school giving the student the choice to engage in PBL, what effect does PBL have on student achievement? The analysis of student achievement in this study suggests that there is no significant difference in the two groups and there is no evidence to support that PBL resulted in a higher achievement of learning surrounding content knowledge. This finding appears to be contrary to some evidence provided by other researchers. Research (Bredderman, 1983; Curbelo, 1984; Hattie, 2009; Hembree, 1992; Marcucci, 1980; Mednick & Wainwright, 1997; Mellinger, 1991; Thomas, 2000) suggested that over time, PBL schooling outperformed the traditional schooling in mathematics and science as well as conceptual and applied knowledge. It was found that PBL students passed the national exam three times more than student from a traditional setting (Cincinnati Public Schools, 1999).

Some of the gains mentioned in the literature are hard to measure through traditional assessment measures, such as the development of critical thinking and problem solving skills, collaboration with others of varying levels, and student motivation. Boaler (1998; 2002b) suggested that the students in PBL were more flexible and acquired more flexible and useful forms of knowledge. The literature (Boaler, 1998, 2002a; Bransford et al, 1990; Curbelo, 1984; Hembree, 1992; Marcucci, 1980; Mednick & Wainwright, 1997; Shephard, 1998) suggested that most student achievement gains were in the area of critical thinking skills where self-reporting of the gain was evident. This study did not support those findings using both the quantitative and qualitative measures from my study. Neither standardized testing data nor survey data supported

gains in student achievement. Interviews with students, parents, teachers and administrators did not support growth in any of the traditional student achievement areas.

As reported in Chapter 2, not all research supported a PBL instructional approach as more effective in raising student achievement results. John Hattie (2009) reported negative effects for PBL surrounding the accumulation of facts, which many studies embraced for evaluating teaching methodologies. David (2008) found that much of the tested basic math concepts produced similar results for both PBL and traditional groups of students. The data in my study supported the research because comparing measures between pre-test to post-test of standardized test results measured were the accumulation of facts. In other words, PBL had equal achievement on traditional achievement tests , but the school in my study did not measure 21st century learning skills learned through inquiry-based teaching and problem-based learning. Hattie (2009) also synthesized several research projects surrounding science content with PBL programs that differed from the traditional methodology. The meta-analysis revealed that the effect size of learning the science processes was greater than the effect size of student achievement in science content. This is discussed further in implications for action and recommendations for further research.

Research Question 2: How do the perceptions of students and parents in the PBL setting compare to the perceptions of student and parents in the traditional setting?

Preparation for the real world. As mentioned earlier, both PBL and traditional students and parents in my study selected *preparation for the real world in which we compete for jobs* as most important. The difference revealed in the interview portion of

this study is that the two groups believed that different skills are most important for the students to ultimately be successful in the real work world. The traditional parents and students spoke more often about obtaining good grades and a high GPA to get into a good college. Those students and parents choosing PBL programming spoke more about their students gaining skills that would help them in the careers in the real world. Critical thinking skills that lead to solving complex problems, being able to collaborate with people from different backgrounds, and being motivated to do something that the students love were mentioned most often during the interviews.

Studies in which self-reported data were used as a measure of PBL effectiveness (Baertschi, Gould, & Nutter, 1995; Belland, Ertmer, & Simons, 2006; Beringer, 2007; Boaler, 2002b; Brush & Saye, 2008; Clark, 2006; Grant, 2002; Patton, 2012; Peck, Peck, Sentz, & Zasa, 1998; Ravitz & Mergendoller, 2005; Tretten & Zachariou, 1995; Vanderbilt, 1992) resulted in high levels of student engagement. It was reported that students, working both individually and cooperatively, felt empowered when they used effective work habits and applied critical thinking to solve problems (Edutopia, 2001; Ljung & Blackwell, 1996; Shepard, 1998).

Overwhelmingly, the students and parents in both groups of this study during the survey did not express student gains in areas such as: high levels of student engagement, working cooperatively, and developing critical thinking to solve problems. They were most concerned about not wanting grading that is based on the collaborative efforts of the entire group. The interviews with both groups also revealed that grading of collaborative group projects and assignments was a concern of all participants interviewed. The PBL students and parents were more interested in collaboration with people of varying

background and abilities, but they were still very cautious about one student doing all of the work and everyone taking credit for it.

As mentioned in Chapter 2, schooling in the United States has traditionally been set up as an individual journey with tracking of students by ability through upper grades in the K-12 system (Brooks & Brooks, 1993; Bullard & Bullock, 2006). This sorting in high schools has been based mostly on standardized achievement results and letter grades. In my study, the traditional students and parents shared concerns about grading and working with students of lesser ability, rather than expressing value about the collaborative process. This also connects with the literature in that researchers (Barron et al., 1998; Brown, 1992; Brown & Campione, 1996) suggested many students may be used to working with others, but not with collaborating, giving feedback, or understanding how their own work blends with the work of others. Many times student groups often fail to distribute work equitably on their own. Teachers and students need to collaboratively develop norms that address strategies for ensuring individual accountability, which provides a structure whereby student groups become experts on different topics. Then, students should be regrouped to share their knowledge with others (Barron et al., 1998).

Understanding past practices may lead to possible reasons for the negative perceptions from traditional parents surrounding collaboration with students of different backgrounds and abilities. Many of the students and parents who avoided the PBL opportunity did so because of not knowing the expectations of PBL programming. They also believed their students had been successful in the traditional programming based on what was most familiar in measuring success. It was clear that my participants did not

place value on working collaboratively with people of different backgrounds and ability levels.

Development of inquiry-based processes. The review of literature revealed that PBL involves in-depth investigation of a real work topic and is a way for students to develop true understanding of concepts by making connections and developing their own meaning (Henton, 1996; Perkins & Salomon, 1998; Vygotsky, 1978). From the literature, an argument can be made that the connections made by students, which are facilitated by teachers, lead to construction of knowledge based on their experiences (Dewey, 1910, 1916; Stanford Encyclopedia of Philosophy, 2005). Many schools have traditionally followed a transmission model in which a teacher passes information to students and basic skills and facts are taught through direct instruction. In this approach, knowledge is transferred from the expert to the novice, primarily through lecture or print (Brooks & Brooks, 1993; & Bullard & Bullock, 2006).

The literature (Polman & Pea, 1997) proffered that the development of inquiry-based processes as one of the major benefits of PBL. The research also (Blumenfeld, 1994; Edelson et al., 1999) documented the challenges that students and educators have with implementation of this design for learning. Some students had difficulty with the process of inquiry and elected to follow unproductive paths. Students who had difficulty constructing mental models to guide them through the process needed strategies that help them deal with open-ended situations or problems that are not well defined. As the research (Bransford, Brown, & Cocking, 1999; Darling-Hammond et al., 2008; Shear, Novais, Means, Gallagher, & Langworthy, 2010) in Chapter 2 suggested, teachers need to learn strategies to help cognitive coach students, which allows students to retain

control over their project work and assists them in making good decisions about next steps to take.

In this study, both PBL and traditional students and parents also viewed as less important that students should drive their own learning through inquiry. The interview data revealed those who chose PBL instruction did not understand the benefit of inquiry-based learning. There was no mention of inquiry-based learning in the interview responses. There are three possible reasons for the lack of understanding about the value of inquiry-based learning. First, the teachers may have not fully understood the cognitive coaching design of PBL. Second, if the teachers did understand the importance of skillfully guiding students through their work, they may have not communicated the design well enough for the knowledge to be transferred to the students and parents. Third, it could be possible that the design of the interview questions did not illicit detailed responses in this area. This is discussed further in the recommendations for further research.

Research Question 3: What are the perceptions of teachers in a traditional setting, teachers in the PBL setting, and with administrators surrounding both learning models?

PBL proponents claimed in the research (Steepen et. al., 1995) that the PBL methodology produced high-performing teams. For this to happen, teachers must be extremely proficient at facilitating teamwork and leading group problem solving moving students toward excellence and high-performance. All teachers in this study felt that not all groups were high-performing. Many remarked about how difficult it was to have all students of varying ability levels in the same class and working together in groups. It has

been common practice for teachers to have classes that are ability grouped for all subjects. It could be deduced from their comments that this issue was not as much about the PBL structure as they were getting used to a different class make-up than they had ever experienced.

Another plausible reason for the lack of production of high performing student teams is due to the lack of quality professional development for educators as Riel and Becker (2008) indicated is a vital component of a successful PBL program. Comments from the teachers who had the most PBL training in my study were different from those teachers who did not have much training. Most of the comments from the teachers supported the idea that the course pairing and integration of subjects were not well matched and course content was not blended well, which Herzog (1994) suggested was a challenge of PBL implementation. The teachers who planned together in my study, however, expressed that course objectives blended together better than those who did not plan together. Two teachers believed that when the course content was designed surrounding real world situations, the deep understanding of the course was learned. In those cases, teachers felt students were learning to solve a problem and use the solution in a real world context. These teachers felt the collaboration was positive due to student contracts, group contracts, and assigned roles for team members. These teachers were the participants who were disappointed that PBL had been removed as a choice for students.

Barriers to implementation. The findings in this study correspond with the literature most in the area of challenges associated with enacting PBL. There were far more barriers than strengths to implementation revealed in this program review. The research (Barron et al., 1998; Brown, 1992; Brown & Campione, 1996; Cognitive and

Technology Group, 1991; Edelson et al., 1999; Klein, O'Neal, Dennis, & Baker, 1997; Meyer, Turner, & Spencer, 1997; Polman & Pea, 1997; Scardamalia & Bereiter, 1991; Scardamalia et al., 1989; Sage, 1996) pointed to the challenges to (a) scheduling within the school structure, (b) developing inquiry-based processes with balancing teacher-led and student-led learning experiences (c) technology and the use of a cognitive tool, (d) facilitating multiple student groups of varying abilities, (e) lack of quality professional development, and (f) lack of quality assessments. This study connected with the research in that every challenge suggested in the research was evident in the study.

Scheduling. Edelson et al. (1999) described a number of practical constraints associated with the organization of schools that interfere with successful inquiry, which included inflexible schedules in schools. Organizers of the PBL programming in this study were forced to program PBL into a regular traditional schedule. This was due to the reaction of the parent group who were opposed to every student having part of their day be delivered through PBL methodology. The alternative was then to develop a program for some students, but not all students. It was reported by two teachers and one administrator that some students felt forced into PBL because it would fit into their schedule better than traditional classes. The reason that they felt that they had been told to choose PBL was due to the blending of the subjects and credit hours obtained and not because of the different methodology. Others felt that they did not really have the opportunity, because they had to follow a tightly-prescribed schedule to be able to fit all their courses in before graduating.

Integration of subjects for the PBL experience. There was little research found on how to successfully implement the integration of subjects in PBL; however, Hertzog

(1994) suggested that the perceived need on the part of teachers to structure time to cover all academic subjects tended to interfere with the effectiveness of PBL for integrating subject matter areas and providing for in-depth learning.

Teachers and administrators commented on how hard it was to develop a driving question when delivering instruction using this method. The blending of two or three subjects into one course made the driving question challenging. It was challenging to reach all goals in each subject and balance the workload between those subjects that were blended into one course. Some respondents reported that it was hard to blend the objectives of the courses together. A few teachers reported that blending the course objectives into one course was not difficult if planning was a collaborative effort among all teachers. One plausible reason for the differing perspectives may be due to teachers' familiarity of their content objectives much better than those of their colleagues' courses. Collaboratively planning together in advance appeared to be the key in making the objectives clear for the PBL course.

Technology. Students, parents, and teachers expressed considerable frustration with the lack of technology integration that had been a selling point to choosing PBL. There were several barriers to the use of successful technology in this study. The technology that was deployed did not work with the school's connectivity capabilities and the problem was not adequately addressed. The teachers also lacked the knowledge of how to use technology as a cognitive tool, which is again tied to the lack for professional development.

As reported in Chapter 2, studies relating PBL to 21st century skills (Hixson et al, 2012; Jonassen et al., 1991, 1999) reported that technology skills were an important skill

set for students to learn. These skills refer to students being able to manage their learning and products, using appropriate information and communication technological items. In addition, technological tools create avenues for teachers and students to collaborate, explore topics, share content, engage in meaningful academics, provide an environment that scaffolds the learner's PBL experience, and manage projects (Buck Institute for Education, 2012).

Professional development. The literature review (Bradley-Levine et al., 2010; Buck Institute for Education, 2011, Jonassen et al., 1991) clearly suggested that professional development had a positive impact on 21st century teaching and learning. The lack of professional development can present a challenge for implementing PBL (Marx et al. (1991, 1997). When teachers must modify their practices, they can feel like beginners again, which often results in teachers feeling vulnerable. Planning for PBL is time consuming and complex in comparison to traditional classrooms where teachers have access to texts, tests, and other materials. PBL teachers should not be a position of having to construct an innovative instructional model on their own. The conclusion that can be drawn is that PBL teachers need professional development, school and district support, and opportunities to collaborate in order to plan and enact PBL effectively. Findings suggested careful attention and thoughtfulness is considered in embracing PBL and elements for success are in place, including well-developed and defined projects, collaborative culture, and strong school support (David, 2008).

It was clear during this program review that teachers did not feel ownership in the design of this program and lacked the professional knowledge and skills to make the program a success. Teachers and administrators did not mention professional

development as a key component to implementation of this PBL, which spoke to the lack of training. Students and parents questioned the training of the involved teachers and pointed to the lack of collaboration between teachers. When answering the program review portion of the survey, specifically the statement “Teachers are included in quality training in PBL methodology,” the standard deviation was 1.01 showing the wide range of variance in the answers.

Professional development can lead to staff confidence and increased teachers’ beliefs in their ability to teach students of different ability levels, conduct assessments, and use parents and outside experts in the classroom (Mednick & Wainwright, 1997). This will help students who need support in setting up and directing initial inquiry, organizing their time to complete tasks, and integrating technology into projects in meaningful ways. Even teachers who have recently entered the teaching profession have not been exposed to research on PBL, nor are they expected to have taken courses in the theory and practice of PBL. Findings suggest careful attention and thoughtfulness is considered in embracing PBL unless atmospheres for success are in place, including well-developed and defined projects, collaborative cultures, and strong school support (David, 2008). When staff members feel empowered with knowledge (David, 2008; Bradley-Levine et al., 2010; Toolin, 2004), implementation of innovating initiatives are more likely to be sustainable. Staff commitment to PBL in this study was low. Additionally, over a three-year period of time, the few committed staff members who were the first adopters of PBL left the corporation shortly after PBL became a choice. The principal who originally brought PBL to the school left K-12 education altogether. The new principal was not at the school during the inception of the program and

discovered that teacher buy-in was low. He also felt that almost all of the teachers could not give the reason why PBL was offered. Teachers in PBL, in some situations, did not collaborate as much as needed for implementation to go smoothly. Teachers commented that they were not forced to teach using the PBL format, but it was highly recommended to them by the administrator.

Assessments. Marx et al. (1991, 1997) indicated that teachers have difficulty designing assessments that require students to demonstrate their understanding. Marzano and Heflebower (2012) concurred:

Assessment can become a powerful instructional tool when it is used to help students. It can help them articulate clear goals they wish to reach by the end of some interval of time, and it can provide them with feedback regarding their current status. (p.175)

However, Marzano and Heflebower pointed out that using assessments to do this with 21st century learning skills have not been widely practiced. It was clear from the qualitative analysis of this study that students, parents and teachers were not well-versed in assessment practices measuring the skills that PBL methodologies attempt to teach. It is clear that assessing both academic content, as well as 21st century learning skills is needed and was absent from this study.

Research Question 4: If given a choice, who (students, parents, teachers and administrators) are choosing PBL over traditional settings and why?

Students and Parents. As reported in Chapters 1 and 2, there appeared to be a gap in the research in the area of participants' perception surrounding PBL. The voices of students and parents had rarely been heard, and there was a need to examine the

perceptions of students and parents to discover if they demonstrated changes in behavior and attitudes toward learning as a result of their involvement in PBL and if PBL programming met their expectations. It was important to discover which students and parents chose PBL over the more traditional setting and why they are made that choice.

Research (Mednick & Wainwright, 1997; Patton, 2012) supported PBL as a highly engaging and motivating approach that draws more involvement, interest, and investment in learning from students. The results from the program review in this study connected with the literature because respondents appeared to indicate that students who selected PBL were looking for a change in traditional classes. They wanted to participate in classes that were not based on lecturing and completion of daily homework. Those students who chose PBL did so to engage in a different approach that would connect them with what they saw as their learning strengths and learning style. The PBL students who offered to interview as part of this study stated that student motivation was a factor in their selection based on their perceptions that PBL would be a more engaging way to learn. They also chose PBL because they thought it would connect with what they wanted to do in college or as a career. More male students selected PBL than female students; however, this study did not really address the reason for the difference.

Students chose one of the most valued features on the survey to be the development of critical thinking skills that lead to solving problems. However, no student made mention during the interviews of selecting PBL over traditional programming to gain critical thinking skills. As I reviewed my interview protocol, I wondered if the questions asked of students did not investigate this idea as much as possible. Perhaps probing student responses more would have resulted in more

information on this topic. Another reason may be that a smaller sample of students were interviewed than participated in the survey of most and least valued classroom features. Perhaps the students who were interviewed were not representative of the larger sample of students who completed the survey.

One of the goals set out in my research was to investigate parent perceptions surrounding the implementation of PBL. I found little research addressing this topic, but what I did find supported PBL leading to the perception that even though the project experience was new to the parents, by the end of the project, the parents agreed that the project enhanced their understanding of their children's learning. Yuen (2009) also found that the PBL project appeared to enhance parents' daily communication with their children and developed good teacher-parent relationships.

Students in my study were swayed in their decision making by what their parents thought about what would help them be successful in the future; therefore, parents' reasons for choosing one type of instruction over another mirrored those of their students. There was a different outcome reported by parents who participated in the survey and parents who participated in the interviews. Working collaboratively with people with different skills and backgrounds was the second most valued classroom feature chosen by all parents during the survey. As reported earlier in the study, parents choosing traditional programming spoke out during the interviews against their student collaborating with students of different skills. One reason for this difference may be that the parent interview group was much smaller than the group of parents who were included in the survey of the classroom features most and least valued. Another explanation for the difference may be that parents who agreed to interview may have

emotionally charged perceptions due to their experiences; therefore, their perceptions may lie on extreme ends of the spectrum.

Teachers and administrators. Scheduling issues and lack of buy-in for PBL programming were the main reasons for the choice between PBL and traditional programming that was most often cited by teachers and administrators. The challenge of blending class objectives for the PBL scheduling was mentioned by every teacher interviewed. The school had plans to expand the PBL offerings to juniors in the next school year, blending American studies with U.S. history. Due to lack of commitment to the program and issues surrounding PBL implementation, the opportunity dissolved. One reason for the low participation rate in my study may be attributed to the fading of the PBL opportunities offered at the high school over the time of this study. Staff commitment for new programming is discussed further in the implications for instructional leaders.

Surprises

There were some findings in this study that surprised me. One finding was that inquiry-based learning and student motivation were both classroom features that were chosen as least important classroom features by those students in PBL. Both are depicted in the research as two of the main benefits of PBL. One reason for this difference could be that the students did not understand what the term inquiry-based learning meant on the written survey, but discussion during the interviews may have resulted in a more complete answer.

Another surprise was that students were not choosing programming based on what their friends were choosing. Following friends did not surface as a reason that

students were choosing PBL over traditional learning. It might seem logical that high-achieving students would make choices based on their friends' choices, because high-achieving students had been programmed together for many years.

Some research (Edelson et al. 1999; Jerzog, 1994) suggested that scheduling is a main barrier to implementing a new approach to learning. I understood that this would be an issue, but was surprised to find just how much it was a factor in the decision for students and teachers included in this study.

Conclusions

This section includes the implications for further action as a result of my study. On a practical level, this includes what could be done differently by school leaders because of this research and my recommendations for further research.

Implications for Action for Instructional Leaders

Based on the results of this study, I identified several implications for action by instructional leaders. First, district leaders must commit to new initiatives long enough for educators to learn new methodologies and become experts at providing quality educational experiences for students. Next, district leaders should ensure professional development for staff members surrounding research on student motivation and strategies that focus on student engagement. Additionally, students, staff and parents must understand the importance of learning 21st Century learning skills and how they relate to the preparation of students to compete for jobs in the real world. Another recommendation is that educators must begin embedding 21st Century learning skills as early as preschool. Teachers must understand the research on formative leveled assessments that outline learning objectives and next steps for learning based on

proficiency scales. Also, students, parents and staff must understand the direction of the next generation of standardized testing. Assessable technology tools and resources must also be made available to students and teachers. Another implication for action by instructional leaders involved securing appropriate resources, which include partnerships with include many organizations and community partners from across the region available to support innovation education practices. Last, stakeholders' voices must be heard. District leaders have an obligation to lead the collaborative communication efforts with all parents, students, and community members to ensure that the community embraces a strategic implementation plan and believes in a shared vision to ensure that new initiatives are sustainable. Each suggested implication for action by educational leaders is further explored in subsequent paragraphs.

District leaders need to sustain implementation of PBL long enough for teachers to learn from their new practices and become experts at it. PBL provides opportunities for students to practice 21st century skills (Bangery-Dtowns & Bankert, 1990; Bransford, Brown, & Cocking, 1999; Darling-Hammond et al., 2008; Shear, Novais, Means, Gallagher, & Langworthy, 2010). Research on PBL has not had a substantial influence on PBL practice; therefore, there has not been a widespread acceptance and implementation of PBL (Katz & Chard, 2000). Lack of information on what PBL practices are most productive and an overall framework to guide planning and collaborations lead PBL practitioners in a vulnerable position unable to justify their practices or to sustain their work long enough to become experts at it.

A second implication is that teachers cannot effectively implement a new innovation like PBL unless they are provided professional development on student

motivation and student engagement strategies. As reported in Chapter 2 of this study, according to Blumenfeld et al. (1991), previous attempts at hands-on and discovery-learning curricula failed to reach widespread acceptance because developers did not base their programs on “the complex nature of student motivation and knowledge required to engage in cognitively difficult work,” (p. 372) nor did they give sufficient attention to students' points of view.

The importance of 21st century learning skills must be understood and teachers should use appropriate assessments that measure growth in these skills. A review of the research and theory (Marzano & Hefebower, 2012) surrounding cognitive and conative skills is necessary to help school leaders embed 21st century learning skills into current structures of schools. Understanding the research may lead to systematic ways to infuse these important skills into the current design of many schools. It is my recommendation that cognitive and conative skills are intentionally taught in all classes beginning at an early age as described by Marzano and Hefebower in Chapter 2. Then, partnered with next generation, leveled assessments measuring content knowledge, students could self-rate on how cognitive and conative skills have developed. When using proficiency scales that are clearly defined. The learner will know the next step in the learning progression of acquiring these skills. Teachers could assess students based on specific growth toward proficiency and report progress to parents. Perhaps the inclusion of inquiry-based learning could begin as early as kindergarten to integrate new science content and process standards with 21st century learning skills.

The onset of new student assessment should be embraced by district leadership. Both consortiums mentioned in Chapter 2, Partnership for Assessment of Readiness for

College and Career and Smarter Balance, supported the claim that the Common Core State Standards provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that students need for success in college and careers.

Planning for quality PBL experiences is complex. Educators have less access to ready-made materials such as textbooks and third-party assessments. Educators implementing PBL should not have to construct PBL models solely on their own. Quality and timely professional development for all staff members for such district initiatives is important. Collaborative planning time for teachers should also be provided. During the course of this study, many new resources have become available to help schools understand PBL, such as Project Lead the Way and Curiosity Machine (Curiosity Machine, 2015; Project Lead the Way, 2015). Instructional intensive trainings are readily available. The Midwest has increased momentum in K-12 inquiry-based education over the past few years. Some of these schools have conducted professional development trainings that are designed to capitalize on the knowledge and experiences that provide a platform for dissemination of best practice in innovative teaching and learning (Curiosity Machine, 2015; Project Lead the Way, 2015; Purdue University, 2016).

Partnerships among local universities, state education departments, and state commissions for higher education can work together to support educators. It is recommended that districts rely on others who have implemented PBL and make use of the many resources now available. As educators, we need to collaborate more with like-minded districts and learn from their trials and tribulations before implanting innovative

programming for our students. Specific trainings could include selected workshops from individuals and teams from K-12 schools who are implementing programs that promote inquiry-based learning. For example, sessions on problem and project based pedagogy, engineering design process, integrated STEM curriculum development, strategic planning, and the new science and math standards could be offered. Education research presentations from leading researchers within the area might examine pressing challenges in implementation of inquiry-based education. For example, sessions on integrated mathematics, science, engineering education, and technology education could be offered.

District educational leadership must continue to find ways to acquire up-to-date technology and get it into the hands of students. Technology is merely a tool to enable students to construct knowledge. Understanding cannot be conveyed to students through teachers or technology; rather, students construct understanding themselves through tools provided by their teachers and technology. Teachers can demonstrate specific examples of how the tools of technology can be employed to empower students to construct knowledge and meaning (Marzano & Heflebower, 2013; Moursund, 1999; Woff, 2001).

District leadership must embrace an collaborative effort with instructional staff, students, parents and members of the community if it is felt that the skills that could be obtained from PBL are important enough to offer students opportunities to learn from this method. Reflecting on past mistakes in providing quality professional development should be examined and not repeated. Collaboration and communication between school leaders, teachers, parents and students are essential when starting new programs and embracing a shared vision is essential for building a sustainable program. Respectful

discussions between all interested stakeholders should be a priority. Research supporting new initiatives (Barron et al., 1998), which may involve non-traditional, types of instruction are important and must be communicated effectively. Even as important, a systematic way for stakeholders' concerns and questions to be addressed must be present. Open avenues for continued discussions must be readily available. Educators have an obligation to lead the collaborative efforts with all parents, students and community members.

After analyzing the data, I understand the district's initiative did not include the measurement of most of the 21st century learning skills, which may be a reason for lack of significant achievement findings. These skills include development of critical thinking and problem solving skills, collaboration with others of varying ability levels, student motivation, and an authentic connection with real world application. The next section describes my recommendations for future research.

Recommendations for Future Research

Several recommendations for future research are offered, based on the results of this study. Research involved in using proficiency scales in place of traditional grading to provide corrective feedback for student learning is needed. For schools that are developing proficiency scales, it would be necessary to collect data from the teacher's assessment of cognitive and conative skills and the students' self-ratings to study growth in those skills and then relate these to student achievement. Teachers should provide specific feedback that clearly defines and outlines the next action steps for students.

During this study more males chose PBL than females. Another recommendation is for future studies to include more male participants in the interviews so that students'

and parents' perspectives are adequately captured and explored. One study is not enough to ascertain why more males than females would select PBL over traditional programming. More specific questions on students' reasons for their choices might provide insight on male students' compared to female students' rationales. There were also more females than males who participated in the study. Through the use of purposeful sampling; the male perspective could be better represented in future studies.

Quantitative results suggested that as a result of their PBL experiences, students felt prepared to succeed on the new state achievement tests and knew expectations about how to be successful on assessments. There is not enough evidence from the interviews to explain why students and parents involved in PBL felt this way or whether these perceptions were accurate. Therefore, this is another area for continued research.

Further research is needed to understand the complex nature of student motivation and knowledge needed to engage in difficult cognitive work. If we do not fully understand student motivation and engagement, we may easily resort to learning for traditional standardized testing and further abandon authentic inquiry methodologies (Patton, 2012).

Initially, the discovery of the lack of students' and parents' voices in the literature led me to my research. It was my goal to add to the existing body of evidence of students' and parents' perceptions surrounding PBL. This study unveiled the need for further research that includes purposeful sampling to hear the voices involved with innovative or new initiatives. Future research including urban and rural districts is also recommended.

Summary

PBL involves the students going through an extended process of inquiry in response to a complex question, problem, or challenge. In order for teachers to implement PBL effectively, they must be extremely proficient at facilitating teamwork and leading group problem solving toward excellence and high performance. The challenge of moving to a collaborative form of schooling and learning will involve everyone from educators to parents to students. As I reviewed the literature and compared it to what happened in this Midwest high school, I understand that inquiry-based processes were lost in this implementation, which are at the heart of PBL. During the duration of this study, PBL choices for students have stopped at this high school.

Because the school in this study only used traditional assessment, I was not able to ascertain if these important cognitive and conative skills had been increased for PBL students. The use of proficiency scales to create assessments must be used as instructional tools with the aim of helping students better articulate clear goals. These assessments could provide specific feedback in terms of students' next steps in the learning progression of academic content and 21st century skills. It is the hope that the use of proficient scales will provide students, parents, teachers and administrators with a more accurate picture of student achievement in both academic content and important real-world skills.

Because of the lack of communication and collaboration with stakeholders, the PBL initiative in the school being studied was not successful. Educational leaders must work to truly hear the voices of students, parents, and teachers. It is important that students and parents understand the need for our students to develop 21st century skills as

it relates to future student achievement assessments and workplace expectations. We must clear up any misunderstandings about PBL and reassure parents that PBL is not group grading nor will it take high-level honors opportunities away from their children. Research indicates that PBL can have a positive effect on student achievement if implemented well. District leaders must learn from the research, learn from each other, and not repeat mistakes of the past. Children must be prepared for the challenges of the world in which they live and advocate educational reform through constructivist methodologies.

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Appendix A: Survey

Qualtrics Survey Software

Page 1 of 5

Please provide the following information:

What best describes your role in relationship to Project-Based Learning?

Student

Parent

I (or my student) was involved with Project-Based Learning in 2012-2013 with the freshman class AND in 2013-2014 with the sophomore class.

Yes

No

I (or my student) was involved with Project-Based Learning in 2012-2013 with the freshman class but NOT in 2013-2014 with the sophomore class.

Yes

No

What is your gender?

Male

Female

I (or my student) plan(s) to enroll in Project-Based Learning classes as a junior.

Please select the 3 features of classroom instruction that you LEAST value from the list below:

- work collaboratively with people with different skills and backgrounds
- students drive their own learning through inquiry
- engaging instruction that motivates the students to take an active role in learning
- become proficient communicators
- opportunities to enhance use of technology
- critical thinking skills are learned that lead to solving problems
- preparation for the real world in which we compete for jobs
- grading is based on collaborative efforts of the entire group
- preparation for college and career readiness
- instruction promotes the students' deep understanding of course content
- skills that will be assessed on new state achievement tests

Please rate your experience with your PBL experience at WCHS

Please rate your perspective on the statements below as it pertains to your Project-Based Learning experience at WCHS:

	Somewhat Agree		Somewhat Disagree	
	Agree	Agree	Disagree	Disagree
Students learn important knowledge in course content (Biology, Computer Applications, World History, Digital Design and Art History).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The deep understanding that the teachers want students to demonstrate at the end of the project is clear.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students know how success is measured (appropriate assessments).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PBL methods at WCHS reach all levels of student ability.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students are prepared for college and career readiness skills that will be assessed on new state achievement tests.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate your perspective on the statements below as it pertains to your Project-Based Learning Experience at WCHS:

	Agree	Somewhat Agree	Somewhat Disagree	Disagree
Students build skills such as collaboration and communication with people of different skills and backgrounds.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers incorporate technology into the PBL classes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students connect to the real world by engaging in a process of asking questions, using resources, and developing answers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students present their work to other people, beyond their classmates and teacher.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PBL instruction prepares student for the real world in which they will compete for jobs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate your perspective on the statements below as it pertains to your Project-Based Learning Experience at WCHS:

	Agree	Somewhat Agree	Somewhat Disagree	Disagree
Students involved in PBL build skills such as critical thinking and problem solving.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students become advanced problem solvers in order to solve problems that have multiple solutions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High-performing student teams are present in the PBL classes at WCHS.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students drive their own learning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PBL classes at WCHS teach students how to think critically to work through challenges.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate your perspective on the statements below as it pertains to your Project-Based Learning Experience at WCHS:

	Agree	Somewhat Agree	Somewhat Disagree	Disagree
PBL projects focus on an open-ended question that students explore based on their interests.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students involved with PBL at WCHS create projects that generate interest and curiosity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students are allowed to make choices about the products to be created, how to work, and manage time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students are engaged in the projects that motivate them to take an active role in learning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Students use feedback to develop skills that help them think about what they are learning.

Please rate your perspective on the statements below as it pertains to your Project-Based Learning Experience at WCHS:

	Agree	Somewhat Agree	Somewhat Disagree	Disagree
Processes are in place to communicate all aspects of PBL to parents.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The administrators at WCHS support the Project-Based Learning classes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers are included in quality professional development training in PBL methodology.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group grading based on the collaborative efforts of the entire group is a part of the PBL framework.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers coach students through the process giving them enough support to succeed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Students and their parents will be interviewed as part of this study. If you are willing to participate in these interviews, please include your contact information in the text box below.

Appendix B: Corresponding Survey and Interview Items to Research Items

Research Questions	Corresponding Survey / Interview Item
1. In a suburban high school giving the students the choice to engage in PBL, what effect does PBL have on student achievement?	Survey item: Block 3 Questions 1,2,3,4, and 5 Interview question: 2, 3 and 5
2. What are the perceptions of students in traditional compared to the PBL group surrounding the PBL learning model?	Survey item: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, and 25 Interview question: 1, 2, 3 and 5
3. What are the perceptions of <u>parents</u> in traditional compared to the PBL group surrounding the PBL learning model?	Survey item: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, and 25 Interview questions: 1, 2, 3, 4 and 5
4. What are the perceptions of <u>teachers</u> in traditional classes compared to teachers in the PBL classes?	Interview questions: 1, 2, 3, 4 and 5
5. What are the perceptions of <u>administrators</u> surrounding both learning models?	Interview questions: 1, 2, 3, 4, and 5
6. If given a choice, who (students, teachers and administrators) are choosing PBL over traditional settings and why?	Survey item: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, and 25 Interview questions: 1, 2, 3, 4 and 5

Appendix C: Informed Consent Form

Study Title Project-Based Learning: Stakeholders' Perceptions and Student Achievement Impact

Study Purpose and Rationale

This study will examine the differences between a Project-Based Learning (PBL) classroom and those of a more traditional classroom and will provide a better understanding of why some students are choosing one type of instruction over another. It will also examine if student achievement is impacted and determine stakeholders' perceptions surrounding PBL methodology. It is important to study this issue, as several schools in central Indiana are moving in the direction of organizing parts (or all) of their schools in formats that support and promote PBL. For educators, students, and parents to understand what is involved in this endeavor, we must study the issue by raising important questions to be answered through careful, intentional research. It is my goal to be able to contribute to the current body of research on PBL and to wish to fill the gap in research surrounding stakeholders' perspectives with the PBL approach to teaching and learning.

Inclusion/Exclusion Criteria

Participants are being selected because they have knowledge about the PBL classes at Community High School. Administrators, teachers, parents, and students are considered participants. Students (ages 13-17) and one parent or guardian representing each student will be involved in a survey and a possible interview. Administrators and teachers at the high school will also be interviewed. Participation in each aspect of the research is voluntary.

Participation Procedures, Data Collection, and Duration of Study

Parents and students participation in this study involves taking an online survey using a Likert Scale format (5 if you strongly agree through 1 if you strongly disagree). The survey would be distributed at the end of the students' sophomore year and would indicate whether they have been involved in PBL for one year or two years. They will indicate if they have made the choice to continue PBL into their junior year. The survey will also ask the participants which features of classroom instruction are most valued most and least. The participants will also be asked to rate their experiences with PBL at Community High School as part of a program review.

This study will include collecting and analysing the student achievement test results from the end of the students involved from the end of the their freshman year to the end of their sophomore year in high school to determine the effectiveness of PBL in relationship to a traditional classroom approach. With parent permission, the records of student achievement and aptitude would be examined in order to make comparisons of who is making the choice to be included in PBL.

Interested students and parents would be interviewed. Interviews with six teachers and two administrators involved with the integrated PBL courses will also take place. The duration of the interview will be approximately one hour per participant. Participants have a choice as to where the interview occurs and requests will be honored. The interviews will be conducted with students and parents separately, but will occur on the same day.

Audio Tapes

For purposes of accuracy, the interviews will be audio taped using a technological tool on a laptop computer that is password protected and stored in a locked desk of my secure office. My faculty advisor and I will be the only people to have access to these recordings. They will be used for transcriptions so that I may analyze stakeholders' perspectives and look for emerging patterns in responses. Once the study is complete, the recordings will be destroyed.

Data Confidentiality or Anonymity

Data are confidential which means the identities of the respondents will not be shared. All data related to this study will be kept in a locked desk of my secured office. Community School Corporation and Ball State University will receive a copy of the final dissertation once the study is completed, but the identities of the respondents will not be known.

Storage of Data

Data will be stored within my password-protected Qualtrics account as well as a password-protected laptop, which will be housed in my locked office. The data will be retained for the duration of my dissertation and will then be permanently deleted or shredded.

Risks or Discomforts

There are no anticipated risks for participating in this study. Each participant will be informed during this study that if any time he or she may choose not to answer any questions that make him/her feel uncomfortable and he or she may withdraw from the study at any time.

Benefits and/or Compensation

There are no anticipated benefits or compensation for participating in this study.

Voluntary Participation

Participation in this study is completely voluntary, and participants are free to withdraw permission at any time for any reason without penalty or prejudice from the investigator. Please feel free to ask Shelley Gies any questions before signing this form and at any time during the study.

IRB Contact Information

For questions about your rights as a research subject, please contact Director, Office of Research Integrity, Ball State University, Muncie, IN 47306, (765) 285-5070, irb@bsu.edu.”

Participant Consent

I, _____, agree to participate in this research project entitled, “Project-Based Learning: Stakeholders’ Perceptions and Student Achievement Impact”. I have had the study explained to me and my questions have been answered to my satisfaction. I have read the description of this project and give my consent to participate. I understand that I will receive a copy of this informed consent form to keep for future reference.

To the best of my knowledge, I meet the inclusion/exclusion criteria for participation (described on the previous page) in this study.

Participant’s Signature

Date

Parental Consent

I give my permission for my child to participate in this research project entitled, Project-Based Learning: Stakeholder’s Perspectives and Student Achievement Impact. I have read the study explained to me and my questions have been answered to my satisfaction. I have read the description of this project and give my permission for my child to participate. I also give permission for my student’s academic records to be viewed for the purpose of this study. I understand that I will receive a copy of this informed consent form to keep for future reference.

Participant’s Signature

Date

Researcher Contact Information

Principal Investigator:

Shelley Gies, Graduate Student
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Appendix D: Student Assent Form

My name is Shelley Gies and I am trying to learn about Project-Based Learning (PBL) because many of the schools in central Indiana are moving to designing classes around the PBL model and moving away from traditional classes. If you would like, you can be in my study.

If you decide you want to be in my study, you will be involved by completing a short survey about how you feel about your PBL experiences and whether you have signed up for classes this year that are in the PBL format. You might also be asked to be part of an interview, along with your parents, to help me gather all of the information on PBL. I would also like to compare the End of Course Assessments from last year to this year in the subject areas that were part of PBL classes.

Other people will not know if you are in my study. I will put things I learn about you together with things I learn about other students who were involved in the Project-Based Learning classes, so no one can tell what things came from you. When I tell other people about my research, I will not use your name.

Your parent or guardian has to give permission for you to be in the study since you are under 18. After they decide, you get to choose if you want to do it too. If you don't want to be in the study, that is perfectly fine. If you want to be in the study now and change your mind later, that's fine with me too. You can stop at any time.

My telephone number is (317) 408-1953 and my email is sgies@cpcsc.k12.in.us. You can call or email me if you have questions about the study or if you decide you don't want to be in the study any more.

I will give you a copy of this form in case you want to ask questions later.

Agreement:

I have decided to be in the study. Shelley Gies has answered all my questions.

Signature of Study Participant

Date

Signature of Researcher

Date