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Teacher and Administrator Perspective of Project-Based Learning

Nicholas Boyers

ACCEPTANCE

This dissertation TEACHER AND ADMINISTRATOR PERSPECTIVES OF PROJECT-BASED LEARNING, by NICHOLAS M. BOYERS, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Philosophy, in the College of Education and Human Development, Georgia State University.

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TEACHER AND ADMINISTRATOR PERCEPTIONS OF PROJECT-BASED LEARNING

by

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Under the Direction of Dr. Kristina Brezicha

ABSTRACT

Project-Based Learning (PBL) is a teaching method in which students gain knowledge by working for an extended period of time on a particular question, problem, or challenge. This dissertation examined teacher and administrator perceptions of the impact of project-based learning on elementary students. The study explored PBL's effects on (a) student academic achievement, (b) student engagement, and (c) students' ability to inquire and reflect on their learning. What are teacher and administrator perceptions of the effect of project-based learning on student outcomes at a suburban elementary school? Three guiding questions served as the foundation of the study. What is the perception of teachers and administrators with regards to PBL's effectiveness on student engagement? How do teachers and administrators describe the impact of PBL on student inquiry and reflection? What is the perception of teachers and administrators on PBL's impact on student academic achievement? Using case study methods this dissertation focused on student engagement, reflection, and academic achievement. Data was gather from teacher and administrator interviews, classroom observations, and student artifacts. Individuals in the study described their experiences with PBL, and how project based learning had affected student outcomes. Purposive sampling was used because the teachers and

administrators selected had been through extensive PBL training with the Buck Institute. Participants in the study include two administrators and four teachers who attended the Buck Institute training. The researcher observed student presentations at the end of the project based learning experience in each of the six classes lead by the selected teachers. Six 45-60 minute observations were conducted to gain further insight into PBL and its implementation in the classrooms of teachers who attended the Buck Institute training. This study contributes to the literature by providing additional information on the effect of PBL on elementary student outcomes.

INDEX WORDS: Project-based learning, Elementary students, Teachers, Administrators

TEACHER AND ADMINISTRATOR PERCEPTIONS OF PROJECT-BASED LEARNING

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Nicholas Boyers

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DEDICATION

I dedicate this dissertation to my wife, Megan, and daughters Savannah and Harper who have supported me through the last three years of classwork and writing. I love you and dedicate this work to you.

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CHAPTER 1

PROJECT-BASED LEARNING

Project-based learning (PBL) is a pedagogy used across the globe in the 21st century (Bell, 2010; Lattimer & Riordan, 2011). PBL is a teaching method in which students gain knowledge by working or investigating for an extended period on a particular question, problem, or challenge (Larmer, Mergendoller, & Boss, 2015). Employers across the globe report the lack of 21st century skills (creativity, innovation, and global competence) in newly hired workers (Zhao, 2015). Numerous studies indicate PBL affords students the opportunity to develop critical 21st century skills before entering the workforce (Bell, 2010; Lattimer & Riordan, 2011; Filippatou & Kaldi, 2010). Halvorsen, Brugar, Block, & Berka, (2012) indicated there are a "relatively small number of studies" (p.8) conducted on PBL with elementary-aged students versus the number conducted with middle and high school students.

A large body of research exists on the effectiveness of project-based learning for a singular unit or class (Blanchard et al., 2010; Moylan, 2008; Soprano & Yang, 2013; Strobel & Van Barneveld, 2009), especially with students in middle school and beyond; however, less research exists on the benefits of PBL on elementary students. The purpose of this study is to explore the perceptions of teachers and administrators in classes where the teacher has at least three years of PBL experience and has received a minimum of one year of PBL training. This dissertation examines the relationship between PBL and elementary students' engagement, inquiry, reflection, and academic achievement.

Background of problem.

In the 21st century, students are expected to graduate with curricular knowledge and well-established soft skills such as critical thinking, creativity, collaboration, and communication

(Larmer et al., 2015). Employers across the globe report new hires are not fully equipped with the skills required of the 21st century workforce (creativity, entrepreneurship, and global competence) leading to a talent shortage across the globe (Zhao, 2015). Teachers are tasked with the job of further developing students' 21st century skills by providing motivating learning experiences that involve rich inquiry that increase academic achievement. School leaders need to know and understand PBL in order to support its effective implementation.

The Buck Institute of Education (BIE), a nonprofit dedicated to the study and implementation of PBL, defines project-based learning (PBL) as "a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to a complex question, problem, or challenge" (Larmer & Mergendoller, 2015, para. 1). Lattimer & Riordan (2011) characterize PBL as a pedagogical approach in which students work for an extended period of time on an authentic, complex problem. Bell (2010) portrays PBL in a similar fashion, but claims student involvement should direct PBL and student learning should be facilitated by the instructor with the learner's interest being an integral component of PBL.

As Bell observed, "Learners pursue knowledge by asking questions that have piqued their natural curiosity" (2010, p.39). Larmer and Mergendoller (2015) included eight essential elements of PBL: key knowledge understanding and success skills, challenging problem or question, sustained inquiry, authenticity, student voice and choice, reflection, critique and revision, and public product (para 1). In summary, these authors claim PBL is a pedagogical approach where students become the drivers of learning and ask questions relevant to research. Despite various definitions of PBL, all definitions incorporate and expose the importance of student questions and real-world inquiry.

According to Filippatou and Kaldi (2010), project-based learning has grown in popularity in response to the challenges of educating the 21st century learner. PBL enthusiasts point out the opportunity to develop 21st century skills including: "collaboration, critical thinking, problem solving, and digital literacy" (Parker & Lazaros, 2014, p.25). Some educators such as Carolann Koleci, a Harvard University professor who teaches a PBL course titled AP 50, agree with those in the workforce (Perry, 2013). Koleci states, "For today's knowledge-based economy, it's not so much what you know, but what you do with what you know" (as cited in Perry, 2013, p.1). Industries are encouraging educational institutions to provide opportunities for students to engage in PBL (Soule & Warrick, 2015). Children need training and exposure from an early age to better prepare them for a 21st century career (Parker & Lazaros, 2014).

Statement of problem.

A gap exists between student performance and the results employers' desire. 21st century skills need to be better developed in students before they reach the workforce (Bennett & Thompson, 2011). In a study of employer preferences for employee skill sets, Archer and Davidson (2008) found, "Employers ranked communication skills and team-working skills as the highest two skills. Literacy and numeracy were 8th and 9th" (p. 10). Yet, Soule and Warrick (2015) noted many high school graduates are unprepared in skills such as "professionalism and work ethic, critical thinking and problem solving, and creativity and innovation" (p.180). Soule and Warrick's survey found over one-half of employers believed new hires were unprepared. Zhao discovered, "worldwide, 35% of over 38,000 employers surveyed report they are experiencing difficulty filling jobs due to lack of available talent" (2015, p.132). Zhao recommends giving students opportunities to engage with the global community as well as creating authentic, real-world products to better prepare them for the demands of a 21st century

career. Zhao believes that if students had greater choice and ownership over their learning, 21st century skills would develop because of their natural interest in the content. In order for students to attain mastery over 21st century skills, they must have years of practice, making it imperative that they receive opportunities for practice starting in elementary school. PBL may be an effective vehicle to bridge the gap between employer preferences and student preparedness. While PBL research is widespread in middle school and beyond, there is less research in elementary school on PBL's effectiveness.

Significance of the study.

PBL research suggests it may develop 21st century skills better than traditional instruction; however, additional research is necessary. This dissertation provides research on teacher and administrator perceptions of PBL's effectiveness on elementary student outcomes related to inquiry, reflection, achievement, and engagement. These outcomes relate to 21st century skills such as critical thinking, problem solving, creativity, and collaboration.

The findings will contribute to the body of knowledge on how PBL works in elementary schools and be useful to elementary schools as they make informed decisions about pedagogical practices. It is important that elementary schools are included in the research to create a natural progression as students transition from elementary to middle and high school. Further information about stakeholder perceptions of PBL will be useful to policymakers when making curricular decisions. School leaders benefit by learning about student outcomes when effective PBL implementation occurs. This case study includes data from teacher and administrator interviews, classroom observations, and student artifacts at a school with a long history of PBL that will be useful in evaluating PBL's effect on student outcomes.

Project-based learning has grown increasingly popular throughout education systems in response to the challenges of the 21st century learner (Filippatou & Kaldi, 2010). PBL enthusiasts point out a need to develop 21st century skills including: "collaboration, critical thinking, problem solving, and digital literacy" (Parker & Lazaros, 2014, p. 25). Others emphasize the need for students to receive training and exposure to technology skills that will prepare them for the demands of 21st century careers (Parker & Lazaros, 2014). Technology is consistently used in PBL and when used appropriately gives students opportunities and exposure to become more comfortable with it as well as engage them at a deeper level (Bell, 2010). Larmer et al. (2015) claim PBL:

> Motivates students, prepares students for college, careers, and citizenship, helps students meet standards and do well on tests that ask students to demonstrate in-depth knowledge and thinking skills, allows teachers to teach in a more satisfying way, provides schools and districts with new ways to communicate to connect with parents, communities and the wider world (p.2).

Due to PBL's increasing popularity, further research is necessary to learn more about the benefits of PBL for K-12 students.

Guiding Questions

This study presents a qualitative case study at a suburban elementary school in the southeastern United States that will examine the effect(s) of project-based learning on student outcomes. Specifically, the study explores PBL's effects on (a) student academic achievement, (b) student engagement, and (c) students' ability to inquire and reflect on their learning. The overarching research question serves as the foundation of the study and asks: What are teacher

and administrator perceptions of the effect of project-based learning on student outcomes at a suburban elementary school? Three guiding questions serve as the foundation of the study.

1 What is the perception of teachers and administrators with regards to PBL's effectiveness on student engagement?

2 How do teachers and administrators describe the impact of PBL on student inquiry and reflection?

3 What is the perception of teachers and administrators on PBL's impact on student academic achievement?

Literature Review

For purposes of this study, the literature review provides information about the variations of PBL. The literature review begins by defining a PBL cycle according to the Buck Institute of Education's gold standard PBL. Four sections on existing PBL research outline the three guiding questions: student engagement, inquiry, student reflection, and academic achievement. The researcher outlines the benefits and challenges of PBL based on previous PBL research in each section. The literature review concludes with a summary of the literature.

Defining PBL.

Bell (2010) portrayed PBL as student-centered with the teacher acting more as a facilitator than an instructor. Bell wrote, "learners pursue knowledge by asking questions that have piqued their natural curiosity" (2010, p.39). This is consistent with constructionism as Crotty (1998) wrote that humans construct meaning "as they engage with the world they are interpreting" (p.43). As students ask questions about topics that interest them, they "construct meaning" to gain further insight into those topics (Crotty, 1998, p. 42). In its purest form, PBL is an approach where students become facilitators of learning and ask questions relevant to

research. While a wide-range of definitions exist concerning PBL, the Buck Institute (n.d.), Lattimer and Riordan (2011), and Larmer et al. (2015) all agree on the importance of an essential question, authentic research, and real-world inquiry where students engage in a process of asking questions, finding resources, and the application of knowledge.

Benefits of PBL.

In a study on PBL in social studies, Gültekin (2005) found PBL helped students become better researchers, problem solvers, and higher-order thinkers. Lee and Lim (2012) highlight other key competencies that can be developed through social rather than lecture based learning including "teamwork, communication, leadership, collaboration, and interpersonal relations" (p. 214). Ilter (2014) enumerates these competencies as the 7 C's which include "critical thinking and problem solving, creativity and innovation, cooperation, teamwork, leadership, intercultural understanding, fluency in communication and information, computer and communication technology, and career and self-development" (p.489). The Buck Institute of Education claims the gold standard for PBL includes a "challenging problem or question, sustained inquiry, authenticity, student voice and choice, reflection, critique and revision, public product" (Larmer et al., 2015, p. 34). As Moylan (2008) declares, PBL involves the students as "active learners in using the 7-C's tools, which prepares them for the world of work" (p.288).

PBL can support the success of students as they pursue higher education and employment. A 2014 study found students were most successful in college when their high schools included student-centered instruction which was defined as project-based teaching, collaborative learning, relevant curriculum, and performance-based assessments (Friedlaender, Burns, Lewis-Charp, Cook-Harvey, & Darling-Hammond, 2014). For example, Jollands, Jolly, and Molyneaux (2012) point out the advantages of PBL in medical education because it "allows

students to acquire not only content knowledge but also knowledge of and practice in the professional behavior of a physician" (p.144). Mills and Treagust (2003) similarly reported PBL is appropriate in engineering schools because "almost every task undertaken in professional practice by an engineer will be in relation to a project" (p.8). Conley (2005) conducted a study of college students and discovered skills that play a critical role in student success included: critical-thinking, analytical-thinking, problem-solving, utilizing feedback, openness to failure, clear and convincing expression, ability to draw inferences and reach conclusions, and time management. Students engaged in PBL may develop these skills. This in turn may make students more marketable as employers desired a similar list of skills in employees: critical-thinking and analytical reasoning skills, the ability to solve complex problems, effective communication both orally and in writing, the ability to apply knowledge to real-world settings, the ability to organize and evaluate information, innovation, creativity, collaboration, and the ability to communicate in diverse groups (Hart Research Associates, 2013). As Hart Research Associates (2013) and Conley (2005) point out, there is not a stark difference between the desired skills sets of educators and employers.

Challenges of PBL.

While many studies report positive outcomes of PBL implementation (Halvorsen et al., 2012), it is important to note there are studies that contradict those findings (Filippatou & Kaldi, 2010; Grant, 2011; Walker and Leary, 2009). In Grant's (2011) study, students struggled with PBL in large part because the students had no prior experience. Filippatou and Kaldi (2010) found students had difficulty retaining content and applying vocabulary. Additionally, students struggled to express their learning through open-ended questions. The teachers in this study had similar levels of experience with PBL, but the amount of training and experience was unknown.

This project lasted eight weeks, but students only engaged in PBL for two to three hours per week. Walker and Leary (2009) found lecture-based instruction might be more effective in students' retaining content knowledge than PBL due to the structure and greater teacher support. These researchers found negative characteristics of PBL, which may relate to the limited experience and time teachers and students had to work with PBL (Filippatou & Kaldi, 2010; Grant, 2011; Walker and Leary, 2009).

Another criticism of PBL is that grading can be subjective since a large portion of it is based on rubrics, observations, and performance assessments (Larmer et al., 2015). Grant (2011) conducted a study with middle school students in a PBL environment and found that participants often chose the easiest route to complete projects. The result was watered down PBL and learning lacking rigor. Students in Grant's study felt projects were easier than test grades even though they were weighted equally. It is important to note the students and teachers in Grant's study had not engaged in a PBL environment and the teachers had not been trained in effective PBL instructional strategies.

Students may not have received enough training and scaffolded support to engage in a rigorous project experience. The results may not accurately portray the effect of PBL on 21st century skills due to the inexperience of the teachers and students as Grant wrote teachers used primarily "didactic instructional methods" such as lectures and teacher directed instruction before the study was conducted (Grant, 2011, p.40). Teachers with minimal PBL experience have not had the opportunities to adapt, change, or fine-tune their practice through experience. Researchers must carefully evaluate studies such as Grant's before determining PBL's effectiveness.

Critics of PBL also worry about social loafing in which students exert less effort when in a group due to their dependency upon group members (Lee & Lim, 2012). If this is the case, it may be hard to measure individual student understanding because not all group members play an equal role in the project. Student interactions play a large role in PBL's effectiveness as well as the way the teacher structures the project. Lattimer and Riordan (2011) claim PBL is unsuccessful when the teacher puts too much emphasis on the final product instead of the learning. The Buck Institute of Education notes on its website: "At its worst, PBL can be a colossal waste of time for all concerned when implemented improperly" (Buck Institute of Education, n.d.). Others such as Filippatou and Kaldi (2010) noted PBL may not be as effective for pupils with learning difficulties who lack reading and writing skills.

Blanchard et al. (2010) used a rubric to determine the level of inquiry used by the teacher in a study with traditional groups and PBL groups working on a high school science project. The study found students in the traditional groups performed better on achievement tests than the PBL groups if the teacher improperly used PBL as an instructional strategy; however, the PBL groups whose teachers were using a high level of inquiry performed much better on the delayed post-test than the students in the traditional groups. A study of PBL by Walker and Leary (2009) compared the effectiveness of PBL programs with traditional programs and found no conclusive case for PBL being better or worse than traditional programs. PBL showed essentially identical outcomes as lecture-based approaches. PBL supporters such as the Buck Institute (Larmer et al., 2015) agree it is an effective strategy when implemented with fidelity; however, a body of research exists showing the negative or neutral effects of PBL when implemented inadequately (Filippatou & Kaldi, 2010; Grant, 2011; Walker and Leary, 2009).

PBL may offer challenges when it is new to teachers. In a 2015, there was a study conducted for high school in-service teachers where participants received PBL staff development. According to the authors, “The five teachers in this study illustrated different conceptual understanding of STEM [science, technology, engineering and mathematics] PBL” (Sunyoung Han, Yalvac, Capraro, & Capraro, 2015, p.71). The study was set up to offer professional development to teachers who had not experienced PBL in their own classrooms; however, two teachers had three years of PBL experience. All participants had at least two years of teaching experience (not PBL) and had a combined 68 years of teaching experience among them. There was a stark difference between the experienced and inexperienced PBL teachers’ ability to implement PBL effectively. According to the researchers, “Teachers sometimes presented different enactments from what the PD providers intended” (Sunyoung Han et al., 2015, p.71). This included teachers not changing their instructional strategies after the training and misconceptions that interfered with their ability to implement PBL properly. The teachers who had prior PBL experience were more positive about PBL than the teachers with no previous experience (Sunyoung et al., 2015). They had more resources and materials because they had accumulated PBL materials over several years, which helped them feel better prepared. The authors from the study suggested that it was important to have follow-up training for new teachers to PBL for at least one to two years and to provide resources to newer teachers to help them feel more comfortable with the new pedagogy. This study adds to the literature on effective PBL implementation in elementary schools with veteran PBL teachers.

Researchers such as Grant (2011), Sunyoung et al., (2015) and Blanchard et al. (2010) conducted studies with teachers who had little to no experience with PBL. The purpose of this study is to explore the perceptions of teachers and administrators in classes where the teacher has

at least three years of PBL experience and has received a minimum of one year of PBL training. By including only participants with PBL experience, the researcher hopes to gain a better understand of PBL's effect on students with experienced PBL teachers.

Student engagement.

Kaldi, Filippatou, and Govaris, (2011) draw upon John Dewey's work from the 1930's to characterize the attributes of engagement as: "relevant to students' lives and experiences, pertinent to the curriculum, involvement of critical thinking and problem solving, stimulation of creative thinking, and support of collaborative decision making by the group" (p. 36). Larmer and Mergendoller (2015) concur with the importance of relevance by writing that authenticity "increases student motivation and learning" (para. 12). Authenticity includes student "concerns, interests, cultures, identities, and issues in their lives" (Larmer & Mergendoller, 2015, para. 12). In addition, Lamer and Mergendoller (2015) agree with Kaldi, Filippatou, and Govaris' (2011) about the involvement of students in the process when they write about the importance of students having a voice in projects to "create a sense of ownership and care" about their work (para. 13). For purposes of this study, engagement includes motivation, relevance, student involvement in decision-making, authenticity, and collaborative decision-making.

According to a report from the National Research Council, "40% of U.S. high school students are operating at a critical low in school motivation" (Myrene-Raappana, 2015, p.1). The High School Survey of Student Engagement surveyed 275,925 United States students from 2006-2009 and found that "49 percent of students in grades 9-12 reported being bored in at least one class every day; another 17 percent were bored in class every day" (Yazzie-Mintz, 2010, p. 6). Researchers asked students to select three reasons why they were bored. 81% of students responded that the material was not interesting, 42% said the material was irrelevant, and 35%

said there was not enough interaction with the teacher (Yazzie-Mintz, 2010). When students were asked which strategies were most engaging, 61% said discussion and debate, 60% stated group projects, 55% said lessons with technology, and 46% said student presentations (Yazzie-Mintz, 2010). Wiggins (2014), a co-author of Understanding by Design, found similar results in a survey of a Midwestern suburban high school. Students reported excessive boredom and suggested teachers should create more active learning experiences and use more discussions (Wiggins, 2014). Surveys such as this demonstrate a need for instruction that engages students more effectively. Due to changing desired skill sets and lack of student motivation, organizations such as the National Academy of Science (2007) and The National Research Council (2012) have expressed a need for innovative changes to educational institutions.

As Chumbley, Haynes, and Stofer (2015) pointed out, as students move throughout school, motivation, a key factor in student engagement, is one of the best predictors of academic success in science. Other researchers such as Milner, Templin, and Czerniak (2011) found a direct correlation between student attitudes and academic achievement. Milner et al., (2011) believed learning environments with a constructivist approach better "motivate students, convince students to see the relevance of science education in their lives, and foster the strategies, skills, and abilities for students to be successful in the science classroom as well as out in the real world" (2011, p.152).

Tamim and Grant's (2013) case study with six teachers in grades 4-12 found PBL to be motivating and engaging for students. Others point out benefits from PBL such as making learning fun and creating enthusiasm in students (Saez-Lopez, Roman-Gonzalez, & Vazquez-Cano, 2016). In a social studies report on second graders, Halvorsen, Brugar, Block, and Berka (2012) reported students improved their academic knowledge of the American Revolution and

had higher motivation for learning the curriculum as a result of PBL. Filippatou & Kaldi (2010) reported similar outcomes with fourth grade students with disabilities on a project about sea animals. The researchers reported, “The majority of pupils appeared to be much more engaged” and improved their “attitudes towards group work, their acceptance in the group and their involvement in the learning process” (Filippatou & Kaldi, 2010, p. 24). These attitudes led them to be “motivationally engaged” throughout the project (Filippatou & Kaldi, 2010, p. 24). The researcher selected student engagement as a component of a guiding question because of the correlation it has to student academic achievement.

For purposes of this study, student engagement includes motivation. Many educators support the notion that students are more engaged when intrinsically motivated (Haywood, Kuespert, Madecky, & Nor, 2008; Froiland, Oros, Smith, & Hirchert, 2012; Ilter, 2014). Haywood et al. (2008) claim intrinsic motivation is more beneficial despite the notion that society embraces extrinsic motivation. PBL may offer more opportunities for intrinsic motivation to occur since students have a voice in their learning (Larmer et al., 2015). Froiland et al. (2012) point out benefits of intrinsic motivation including greater student learning, higher motivation, improved behavior, and greater happiness. Ilter (2014) wrote the purpose of PBL is to “increase students’ intrinsic motivation and to gain learning outcomes by organizing conditions of external motivation because projects encourage students to discuss social events and compare important ideas” (p.489). Ilter (2014) suggested there is motivational value in having students self-monitor and assess their own learning through projects.

Blumenfeld et al. (1991) claim student motivation comes in the learning process when children develop individualized perceptions about the real-world. This process helps them strengthen their attitudes and motivation about learning. English and Kitsantas (2013) conducted

a study that focused on self-regulated learning, a characteristic of PBL. The findings showed "self-regulated learners are able to set goals, plan a course of action, select appropriate strategies, self-monitor, and self-evaluate their learning" (English & Kitsantas, 2013, p.129). As students become aware of their own learning and become self-regulated learners (Larmer et al., 2015), their intrinsic motivation increases (Ilter, 2014).

While engagement is desired over the long-term in employers and educators alike, it may also play a role in the short term with close ties between engagement and academic achievement (Chumbley et al., 2015). Student attitudes towards learning have the potential to affect academic achievement. In a study on PBL in STEM environment, Tseng, Chang, Lou, and Chen, (2013) used questionnaires and interviews to collect data from students regarding attitudes towards science. Students appreciated the ability to learn through practical work and acquired "greater scientific knowledge" (Tseng et al., 2013, p. 100). Students in the study had positive attitudes in regards to engineering that "caused a significant (positive) change" after the project (Tseng et al., 2013, p. 100).

Kaldi, Filippatou, and Govaris (2011) administered a survey to primary students and found higher levels of self-efficacy and motivation in students who engaged in project-based learning. A study conducted in Texas on PBL with elementary students found that projects enhanced students' 21st century skills and engaged students with others through video conferences (Hopper, 2014). In the study, kindergarten students excelled in video conferences with other schools through the opportunity to engage learning with others. Second graders had the opportunity to video conference with students from Canada, which extended into a three-year relationship through pen pal letters and e-mail. In two Texas counties, fourth graders connected

about a river project and demonstrated higher interactions while meeting all learning objectives (Hopper, 2014).

PBL may help increase student motivation (Grant, 2011) through cooperative learning techniques (Ilter, 2014; Filippatou & Kaldi, 2010), self-direction and autonomy, and collaborative projects. Ilter (2014) reported, "projects enhance cooperative learning, creating a comfortable and supportive learning environment, help students increase conceptual achievement, also develop their motivation to succeed academically" (p.494). Grant (2011) noted participants seemed to "grasp motivational elements, self-direction and autonomy that are consistent with the theoretical tenets of project-based learning" (p.19). Other PBL outcomes include "greater understanding of a topic, deeper learning, higher-level reading, and increased motivation to learn" (Bell, 2010, p.39). While many of the studies mention increased engagement and motivation, most of them focus on middle, high school, and college students (Hernandez-Ramos & De La Paz, 2009; Tamim & Grant, 2013; Tseng et al., 2013; Wiggins, 2014).

The little research that does exist on PBL with elementary students shows it increases elementary students' self- efficacy, engagement, and enhances their ability to acquire 21st century skills. PBL may provide students an opportunity to gain self-efficacy, which could lead to greater engagement. In a study on student beliefs impacting motivation, the authors wrote that even if a student believes that everyone can be successful if they put in the effort, struggling students don't necessarily believe that about themselves (Lin-Siegler, Ahn, Chen, Fang, & Luna-Lucero, 2016). Hernandez-Ramos and De LA Paz's (2009) findings showed similar results to Lin-Siegler et al. (2016); PBL increases engagement and helps students' beliefs about themselves. Hernandez-Ramos and De La Paz (2009) conducted a study with a control group

and a comparison group . The comparison group participated in PBL activities while the control group received traditional instruction. Both groups received pre and post-tests that measured student attitudes and engagement. The comparison group demonstrated higher content knowledge and had much higher engagement than the control group. Lin-Siegler et al. (2016) pointed out that student beliefs play in a role in motivation. Thus PBL may serve as a vehicle to help students gain self-confidence, exert additional effort, and in turn increase academic achievement. The literature includes less information on PBL for elementary students; therefore, this qualitative study will focus on elementary student outcomes related to engagement.

Inquiry

Inquiry is a critical component of the PBL process as students seek to find answers to driving questions through research and continual questioning. Capps and Crawford (2013) state there are multiple elements of classroom inquiry. Inquiry can be thought of as a "content area" in which "learners begin to understand how scientists do their work" (Capps & Crawford, 2013, p. 499). Students must understand the importance of asking questions, performing investigations to attain solutions to problems, and be able to articulate solutions. The second element is the students' ability to carry out inquiry, which includes "asking and identifying questions, planning and designing experiments, collecting and using data, and connecting data as evidence with explanations" (Capps & Crawford, p. 499). The Buck Institute of Education writes that inquiry is more active than simply looking something up in a book; rather, one must "seek information and investigate" (Larmer & Mergendoller, 2015). For purposes of this study, inquiry relates to student driven questions, research to solve questions, planning and designing experiments, collecting data, and providing explanations.

Inquiry and student reflection are an integral part of the PBL process (Bell, 2010; Larmer et al., 2015; Lattimer & Riordan, 2011). According to the Buck Institute, PBL "begins by students asking 'what do we know?' and 'what do we need to know?' to solve the problem or answer the driving question" (Larmer et al., 2015, p. 39). Questions lead students to begin "investigations" and "research to be conducted" (Larmer et al., 2015, p.39). According to the Buck Institute, inquiry does not mean research in a traditional format; instead it may require students to interview experts in the field, implement an experiment, conduct online research or field work (Larmer et al., 2015). As students find the original answers to their questions, they may come up with additional questions which leads to a "cycle or spiral as students dig deeper and deeper" (Larmer et al., 2015, p. 39).

English and Kitsantas (2013) found, "inquiry approaches are similar (to project and problem-based learning) in that they engage students as researchers, prompting students to learn how to ask important questions, design and conduct investigations, collect, analyze, and interpret data, and apply what they have learned to new problems or situations" (p.130). Roessingh and Chambers (2011) stated inquiry is becoming increasingly popular at higher educational institutions because of the need to develop students who have "good communication skills, creative and critical thinking skills, and a mindset for problem solving and innovation in a world that is increasingly complex and unpredictable" (p.60). They claimed there is a shift in teaching methodologies from "lecture-based to an open-ended process-oriented model that values inquiry" (Roessingh and Chambers, 2011, p.60). It is important to note if PBL use is consistent and frequent, students may have greater opportunities to develop an inquiring outlook.

In a study on inquiry in science classrooms Mumba, Banda, Chabalengula, & Dolenc, (2015) found inquiry-based classrooms increase student motivation, enhance confidence,

develop problem solving skills, provide a greater understanding of concepts, and promote self-esteem; thus illustrating the relationship between engagement and inquiry. According to the findings of Sever and Guven (2014), "teachers agreed that the inquiry-based learning had changed students' resistance behaviors in a positive way" (p. 1603). Inquiry has positive benefits for students and can be aided by providing students opportunities to reflect during the inquiry process.

Reflection

The Buck Institute of Education refers to John Dewey's writings when they write, "we do not learn from experience. We learn from reflecting on the experience" (Larmer & Mergendoller, 2015, para. 14). Berger (n.d.) writes about the importance of students' thinking about their work which improves its quality by reflecting and making revisions on multiple drafts. In a quality project, students should have an opportunity to refine their product through "multiple drafts" (Berger, n.d., p. 1). Blumenfeld et al. (1991) write about the importance of students formulating new ideas as a result of thinking about their work. Students need opportunities to think about what they are learning and why they are learning it through informal dialogue, journal entries, formative assessment checks, discussions at checkpoints, and public presentations. Some tools used to help students reflect are self and peer-reflection assessments, teacher evaluations, journal entries, and discussions.

Another component of the PBL process is the importance of self-evaluation (Bell, 2014; Jerzembek & Murphy, 2013; Larmer et al., 2015; Lattimer & Riordan, 2011). According to Boss (2014), projects lend themselves to natural reflection. Bell (2010) states in order to gain the most benefits from PBL, students should partake in a self-evaluation at the end of a project to assess their personal learning and collaboration among the group. On the other hand, English and

Kitsantas (2013) include reflection as a part of "phase 3" of PBL where students reflect on the learning targets and processes. During this phase, students go public with their learning through a presentation or shared conclusions.

English and Kitsantas (2013) claim that during phase three(presentation phase) students are able to see if their learning aligns to the standards through the help of peers. By comparing their performance to others who approach problems differently, it allows them to reflect on why their project succeeded or failed and how satisfied they are with the project. Students frequently reflect upon necessary changes to improve the project (English & Kitsantas, 2013). English and Kitsantas (2013) asserted reflection continues through the presentation phase as students "share projects with the community who could provide feedback" (p.137) about whether the presentation was effective and next steps for further research. Students continue to learn through feedback received from audience members and are required to respond to listeners' questions.

Students also need opportunities to have their work critiqued by classmates and experts through formal and informal sessions. As such, peer evaluation is another common form of reflection in PBL where students modify their product from oral and written feedback from peers (English & Kitsantas, 2013; Lee & Lim, 2012). English and Kitsantas (2013) write about the benefits of peer reflection during all phases of a project. During phase two (inquiry phase), students benefit from peer input into driving questions and research which leads to "greater understanding" (English & Kitsantas, 2013, p. 134). Additionally, during phase three (presentation phase), students benefit from peer reflection after presenting projects through "peer evaluation and peer-to-peer comparisons" (English & Kitsantas, 2013, p. 137). Lee and Lim (2012) state "Peer evaluation is an effective way of allowing every student to participate in team-

based learning and monitor the process, as well as the product, of team learning" (p.215). Peer evaluation aides in student reflection by providing the perspective of others.

Reflecting on projects allows students to gain additional insight and experience a deeper level of learning. At High Tech Middle (HTM), a PBL school in California, Lattimer and Riordan (2011) found benefits of reflecting on a failed project. Students had opportunities to see where the problems were with the project and were able to learn how to correct it. Students at HTM discovered the value in the learning that takes place, even when the project does not go according to plan. This is especially evident in the required written reflections and "comments to teachers, parents, and community members during presentations" (Lattimer & Riordan, 2011, p.22). Shome and Natarajan (2013) concluded self and peer-assessments allow students to become more critical of their work and require them to set more rigorous goals. In a study on PBL with 11-18 years olds, Jerzembek and Murphy (2013) highlighted the importance of helping students select "age appropriate self-monitoring tools that facilitate self-reflection" (p.215). Using age appropriate tools and self-reflection is crucial for successful learning during PBL (Bell, 2010; Jerzembek & Murphy, 2013; Lattimer & Riordan, 2011; Shome & Natarajan, 2013).

Self-reflection, peer-reflection, and public presentations are an essential part of the PBL process (Larmer et al., 2015). This study provides insight into PBL's potential to help elementary students inquire and reflect. For purposes of this study, reflection relates to students' thinking about their processes and learning and focuses on the impact of reflection on the formulation of new ideas.

Academic achievement

Armstrong writes that academic achievement includes "academic content and skills" (2006, p. 1). This study focuses on academic content (literacy, science, social studies, and math)

and academic skills (problem solving and critical thinking). This study focuses on student academic achievement in relation to students' knowledge of state standards as measured through teacher perceptions of student performance on classwork assignments, classroom assessments, and oral responses during student conferences and presentations. Academic achievement is often associated with standardized assessment. This study does not include standardized assessment data; however, participants' perceptions of PBL's effect on standardized assessment are included. This study does not consider academic achievement through quantitative data collection; however, it is important to review research pertaining to PBL's effect on standardized assessment. The literature highlighted in this section outlines several studies that examine students who have had PBL opportunities and their performance on standardized assessment.

Engagement, inquiry, and reflection have an impact on student achievement (Larmer et al., 2015). Ilter (2014) compared PBL groups to traditional groups using a teacher made pre/posttest and reported "project-based learning was found to create more positive effects on students' conceptual achievement" (p.495). Filippatou and Kaldi (2010) conducted a PBL study on academic performance with fourth-grade students who had learning difficulties and reported "pupils with learning difficulties believed they could perform better in the environmental studies than they did before, they scored higher in this subject area" (p.23). High Tech Middle is a fully implemented PBL school where 99% of students attend college and achieve test scores among the highest in the district (Lattimer & Riordan, 2011). In cases such as High Tech Middle, PBL increases student achievement as evidenced by "students' written project reflections as well as their comments to teachers, parents, and community members during their presentations of learning and student led conferences" (Lattimer & Riordan, 2011, p. 22).

New Tech is another fully implemented project-based learning high school where students work on integrated two to eight week projects and have opportunities to engage in internships and dual enrollment programs. Students at New Tech thrive on standardized assessments and achieving success beyond high school. According to a 2014 report, "New Tech students graduate students at a rate 14% higher than the national average, enroll in college at a 9% higher than national average, persist in college at a rate of 83%, grow 77% in higher order thinking skills between freshman-senior years of high school than comparison group" (New Tech Network, 2014, p.2).

The New Tech report claimed the success stems from the project-based learning model where students are able to "learn disciplinary knowledge and skills to conduct inquiry and solve real-world problems" (New Tech Network, 2014, p.8). Students have ownership over their learning that enables them to develop "a sense of agency, a skill essential in college, career, and civic duty" (New Tech Network, 2014, p.8). High levels of engagement was evidenced by their "95% attendance rate across elementary, middle, and high schools" (New Tech Network, 2014, p. 9). Engagement leads to achievement by giving students ownership over their learning, increasing attendance, and providing relevant learning experiences.

Other studies on PBL have shown similar results to the report at New Tech. A study in Texas of 528 students at three high schools found Hispanic students who engaged in PBL over a period of three years showed higher growth and graduation rates than students who did not (Han, Capraro, & Capraro, 2016). Smith and Pastor (2016) found PBL allows students to be more creative and apply their knowledge to real-world applications while increasing achievement. As PBL exploration continues, student performance must be measured in the classroom as well as on standardized assessments. Schools report positive outcomes with PBL due to the longevity,

engagement, and training the teachers have received around PBL instruction (Han, Capraro & Capraro, 2016; Catapano & Gray, 2015, New Tech Network, 2014).

Lattimer and Riordan (2011) report there may be evidence that PBL is more effective than traditional methods in increasing achievement on standardized tests. They report students at High Tech Middle, a PBL school, have among the highest standardized test scores in their county (Lattimer & Riordan, 2011). Boaler (1999) conducted a three year study on two schools in England where one taught mathematics using traditional methods (rote learning) and the other used open-ended projects (project-based school). In both schools, students' test scores were nearly statistically identical at the beginning of the study. The students at the project-based school attained "significantly higher grades" on the national exam at the end of the three years (p. 264). Three times as many students at the project-based school received the highest possible grade. Boaler's study found students using PBL performed better on standardized tests than students at the traditional school. A more recent study concluded that high school students who received PBL math instruction performed higher than students who did not (Han et al., 2016). Summers and Dickinson (2012) conducted a study on social studies PBL. The study examined how curriculum prepared students for life beyond school and consisted of an experimental and control group. While studies such as Strobel and Van Barneveld (2009) claim PBL may be less effective for short-term knowledge acquisition, Summers and Dickinson (2012) found students who received PBL scored significantly higher on the state mandated exams than the students who received traditional instruction. Summer and Dickinson (2012) concurred with Strobel & Van Barneveld (2009) that "long-term knowledge retention favored PBI over traditional methods of instruction" (p. 54). While the aforementioned studies related to middle and high school

students (Boaler, 1999), Thomas (2000), and Catapano and Gray (2015) had similar results with elementary students.

Thomas (2000) conducted a study in Iowa that looked at elementary PBL schools' performance on the IOWA Test of Basic Skills versus traditional schools. The PBL schools went from "well below average" to the district average in two schools and to "well above the district average" in another school. Moreover, in three years, reading gains ranged from 15% in one school to over 90% in the other two schools while the district average remained the same (Thomas, 2000). Another study concluded that elementary students benefited academically from a Saturday school PBL program despite only having PBL instruction one day a week (Catapano & Gray, 2015). While there is still research to be done on the effectiveness of PBL in regards to academic achievement, there is substantial evidence, when implemented correctly; PBL can positively affect student achievement (Boaler, 1999; Capraro & Capraro, 2016; Catapano & Gray, 2015; Thomas, 2000; Han, 2016).

Strobel and Van Barneveld (2009) conducted a meta-synthesis to analyze when PBL is more effective than traditional instruction. Their results showed that students performed better using traditional methods when the assessment measured the retention of short-term knowledge. On the other hand, when assessments required students to recall a wider range of information, they performed better if they had PBL as an instructional strategy. This was especially true when the assessments included short answer or questions requiring further elaboration. When researchers gave students the same assessment 12 weeks to two years after the period of instruction, the results "significantly favored PBL" (Strobel & Van Barneveld, 2009, p. 54).

In summary, students performed higher on standardized assessments that measured basic knowledge and required students to retain the knowledge for a short period using traditional

methods. However, when assessment questions required elaboration, application, or were administered after a given period of time students performed better when engaged with PBL method of instruction. Studies like the ones conducted by Thomas (2000) and Boaler (1999) suggest PBL students can attain higher results than traditional students on standardized assessments.

While PBL does seem to improve students' standardized test scores in some cases, instructional strategies such as PBL may present challenges in how to best assess student mastery and the development of 21st century skills (Boss, 2012). The Buck Institute of Education (BIE) admits grading in PBL is different than traditional grading (Larmer et al., 2015). At BIE workshops, facilitators work with teachers to develop performance rubrics to assess student products. These rubrics measure both the mastery of learning targets and the development of 21st century skills (Boss, 2012). Boss (2012) claims alternative assessments such as performance-based assessments where students are asked to exhibit, apply, and reflect on knowledge acquisition may be more appropriate to assess PBL. As a result, it may be difficult to measure PBL's effectiveness using traditional standardized assessments such as assessments historically administered by NAEP. Boss (2012) predicts changes will be made to standardized assessments to better align with instructional strategies such as PBL.

PBL Cycle.

This study focuses on the BIE's "gold standard PBL" which includes "student learning goals and essential project design elements" (Larmer & Mergendoller, 2015, para.4). A gold standard project includes key student learning goals: knowledge and understanding as well as success skills. Students ask complex questions, aligned to standards, with the goal of creating a product to highlight their learning. The school in this study uses many of the Buck Institutes gold

standard components as all projects begin with a standard-aligned driving question and additional student generated branching questions that serve as the foundation of the research. Key success skills include: “critical thinking/problem solving, collaboration, and self-management” (Larmer & Mergendoller, 2015, para. 6).

In addition, gold standard PBL includes essential project design elements throughout a project cycle. Students create a challenging driving question to investigate a real-world problem. The driving question serves as the foundation and driving force behind the research project. Sustained inquiry occurs throughout the project as students seek information from a variety of sources. For a project to be gold standard, inquiry should not happen in only one phase of the project, but throughout the entire project cycle. Additionally, projects should be authentic. According to Larmer and Mergendoller (2015), authenticity means “real or genuine” and “real-world” (p.1). Providing authentic learning opportunities may increase engagement and student learning. Larmer and Mergendoller (2015) write “authenticity increases student motivation and learning” (para. 12). In gold standard PBL, authenticity could include genuine contexts (scenario-based PBL), real-world processes, impact on others, or creating a product used by others. Students need voice and choice in the project to have ownership over their learning. This could include a say in the driving question, research methods and sources, or the final product they select.

Reflection is another key component of gold standard PBL. During a project, students should reflect on “what they’re learning, how they’re learning, and why they’re learning” (Larmer & Mergendoller, 2015, para. 14). Reflection can take place informally or formally through journals, formative assessments, conferring at checkpoints, and student presentations. Through the critique and revision phase, students give and receive constructive feedback from

peers and teachers through rubrics and protocols. Lastly, gold standard PBL includes a public product. The Buck includes three reasons for having students create public product:

> 1) a public product adds greatly to PBL's motivating power and encourages high-quality work, 2) by creating public product, students make what they have learned tangible and discussible, 3) making student work public is an effective way to communicate with parents, community members, and the wider world about what PBL is and what it does for students. (Larmer & Mergendoller, 2015, p. 15)

Incorporating student learning goals and the essential project design elements ensure project cycles meet the Buck Institute's gold standard PBL requirements.

Summary

The literature explores how students construct knowledge and understanding through PBL. Project Based Learning proponents claim when students are able to have a voice in their learning through projects, they are more engaged, develop 21st century skills, and perform at higher levels (Bell, 2010; Larmer et al., 2015; Lattimer and Riordan, 2011). Skeptics argue PBL offers too much student choice and opens up opportunities for social loafing (Grant, 2011; Lee & Lim, 2012). Others remain unsure of the effective on student test scores (Strobel & Van Barneveld, 2009). Some argue PBL may encourage subjective grading and a lack of rigor when implemented ineffectively (Filippatou & Kaldi, 2010; Grant, 2011; Lattimer & Riordan, 2011).

Further some studies investigated PBL with inexperienced teachers (Grant, 2011; Han et al., 2016). While researchers have conducted studies on the effect of PBL on high school and college students in engineering (Mills & Treagust, 2003) and medical field courses (Han, Capraro, & Capraro, 2016; Mumba, Banda, Chabalengula, & Dolenc, 2015; Perry, 2013; Summers & Dickinson, 2012) and shown its effectiveness , more research needs to be completed

to better understand PBL outcomes on elementary students. The sum of research suggests students become more engaged with PBL and ultimately achieve at higher levels on some forms of assessments when PBL is executed properly (Blanchard et al., 2010; Ilter, 2014; Lattimer & Riordan, 2011; Summers & Dickinson, 2012). Therefore, the goal of this study is to look at the impact of PBL with teachers who are well-versed in PBL implementation. Using an interpretivist lens, the study will provide further understanding into the effect of PBL on elementary student outcomes (Johari, 2009).

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CHAPTER 2

TEACHER AND ADMINISTRATOR PERCEPTIONS OF PROJECT-BASED LEARNING

This exploratory case study examines teacher and administrator perceptions of the effectiveness of project-based learning (PBL) on elementary students. According to Stake (1995), the research questions should be narrowed down to a few and serve as the foundation of the study helping the researcher formulate observations, interviews, and artifact reviews. The overarching research question asks: What are teacher and administrator perceptions of the effect of project-based learning on student outcomes at a suburban elementary school? In addition to the overarching research question, three guiding questions serve as the foundation of the study.

1. What is the perception of teachers and administrators with regards to PBL's effectiveness on student engagement?
2. How do teachers and leaders describe the impact of PBL on student inquiry and reflection?
3. What is the perception of teachers and administrators on PBL's impact on student academic achievement?

This dissertation presents a qualitative case study (Yin, 2013) of a suburban elementary school in the southeastern United States; it describes the effects of project-based learning on student outcomes. The researcher conducted teacher and administrator interviews to comprehend the impact of PBL on student outcomes. While the student perspective would be valuable, due to time constraints, this study includes only the perception of teachers and administrators related to student engagement, achievement, inquiry, and reflection. Educators will benefit from this dissertation as it provides insight into PBL as an instructional strategy. School leaders will gain

an understanding of the impact of PBL at one well-implemented PBL elementary school. Employers in the global community desire, but struggle to find, employees with well-developed 21st century skills (Zhao, 2015). PBL has the potential to develop 21st century skills in students before they enter the workforce (Bell, 2010; Lattimer & Riordan, 2011; Filippatou and Kaldi, 2010).

Methodology

This qualitative case study (Yin, 2013) of a suburban elementary school in the southeastern United States analyzes teacher and administrator perceptions of the effectiveness of project-based learning. The researcher conducted teacher and administrator interviews to better comprehend veteran PBL instructors' perceptions on the student outcomes outlined above. A large body of research exists on the effectiveness of project-based learning for a singular unit or class (Blanchard et al., 2010; Moylan, 2008; Soprano & Yang, 2013; Strobel & Van Barneveld, 2009), especially with students beyond middle school; however, less research exists on the long term benefits of PBL for elementary students. The study provides insight into the teacher and administrator perceptions of the effectiveness of project-based learning on elementary students.

The researcher's epistemology is that of constructivism which aligns to the idea that students gain knowledge and understanding through activities such as PBL. The researcher explored the perceptions of teachers and administrators and how students create knowledge (Walker, 2015). Gray (2014) wrote, "Meaning is constructed not discovered" so the researcher explored how teachers and administrators perceive the way students construct meaning in PBL (p. 20). The study looks to "understand the world of lived experience" of classroom teachers and administrators through their experiences with PBL to better understand its effect on student outcomes (Walker, 2015, p.37). The researcher explores the perspective of teachers and

administrators on how students and teachers "build understandings" through collaborative experiences with others (Raskin, 2015, p.14).

The researcher's epistemological position influences the theoretical framework. Analyzing the case through an interpretivist framework allowed the researcher to create a quality research design. Interpretivism can also be referred to as "social constructivism" (Creswell, 2013, p.24). Gray (2014) claims constructivism and interpretivism are linked and Dasgupta (2015) concurs by stating:

> The constructivism/interpretivism position assumes that there is no objective knowledge independent of thinking and reality is socially and societally embedded existing within the mind. The reality is changing, and knowledge is constructed jointly by the interaction between the researcher and the researched through consensus. Knowledge is subjective, with multiple realities being experienced by different people differently. (p.148)

Starman (2013) wrote qualitative research is interpretive and focuses on "subjective experiences" and the meanings they have for individuals (p. 30). As a result, the participants' views play an important role in the study's results. Gray (2015) claims, "Exploratory studies seek to explore what is happening and to ask questions about it" and can be beneficial when there is limited information about the phenomenon (p. 36). Limited research exists on PBL in elementary schools with veteran PBL teachers, so an exploratory case study will add to the body of knowledge by exploring teachers' and school leaders' perceptions of PBL's effect on elementary student outcomes.

Research context

According to Stake (1995), the researcher should describe the organization and reasons for its inclusion in the study. This study took place at a suburban elementary school in the southeastern United States where inquiry and PBL have been at the heart of staff development over the last five years. Opened in 2009, the school is 18% free and reduced lunch, and the majority of students are Caucasian (see tables 2.1 and 2.2). The school began as a reading, writing, and math workshop school. Once the workshop model was established, the focus shifted towards inquiry and PBL.

Table 2.1.

Student Ethnicity

	School Year		
	2013-2014	2014-2015	2015-2016
Asian	39(5%)	42(5%)	41(5%)
African American	93(12%)	118(14%)	114(14%)
Hispanic or Latino	93(12%)	92(11%)	90(11%)
Multiracial	31(4%)	25(3%)	41(5%)
White	510(66%)	562(67%)	530(65%)
Total	**773(100%)**	**840(100%)**	**816(100%)**

The researcher selected the school for inclusion in the study because in 2014 they sent eight team members to receive a four-day PBL training through the Buck Institute of Education. The team included six teachers and two administrators. All staff members who participated in the training received an invitation to participate in the study.

Table 2.2.
Student Demographics

	School Year		
	2013-2014	2014-2015	2015-2016
Student Population	773	840	816
Special Education	85(11%)	84(10%)	90(11%)
ESOL	70(9%)	67(8%)	73(9%)
Free/Reduced Lunch	186(24%)	168(20%)	147(18%)
Average Attendance	750(97%)	815(97%)	792(97%)

Four teachers and two administrators agreed to participate in the study (See Table 2.3). The inclusion of the administrators in the training is important as administrators play a pivotal role in helping teachers improve their instruction and they set the tone for the mission and vision of the school (Burke, 2014).

The school was a reading, writing, and math workshop school with an emphasis on inquiry and PBL. Early on, staff development at the school focused on the workshop model and later included inquiry and PBL. The school leadership dedicated the first few years of staff development to training in workshop teaching. In year four, conversations among leadership teams within the cluster (three elementary schools, one middle school, and one high school) led the principals to form a literacy vertical team to improve students' comprehension skills and create uniformity across the cluster. The vertical team conducted a book study of *Inquiry Circles in Action* and site visits to cluster schools to observe literacy classrooms (Harvey & Daniels, 2009). Inquiry was a major focus of the team and training quickly expanded from the vertical team members to the entire school through the work of the vertical team. In addition to school-

wide training, a group of teachers observed a PBL program at the high school and began a pilot of the PBL program at the elementary level. District leaders supported the initiatives at school and regularly invited visitors to tour the school to learn more about PBL. District leaders noticed the school's work with PBL and invited eight staff members to participate in a four-day PBL training offered by the Buck Institute. The team included two administrators, three classroom teachers (kindergarten, 2nd grade, and 4th grade), and the inquiry team (media specialist, technology specialist, and art specialist). The team sought to add the next layer to their work with the workshop model, inquiry, and PBL.

The Buck Institute Training took participants through a learning experience about the essential project design elements through the eyes of a PBL student. The assistant principal referred to the experience as a "cognitive struggle" that simulated the experience students would have with PBL. Some of the team members felt their work with workshop and inquiry helped prepare them for the Buck experience. The assistant principal stated:

> We had so much background knowledge about this philosophy and this style of learning that we kind of entered at a different place than a lot of the other schools who were just trying to grapple with what is this even meaning and how would it look?

The team spoke of parallels between PBL and inquiry; however, there were some differences in philosophy in the trainers from the Buck and the team members of the school. Team members spoke of the importance of "frontloading" content which team members felt enabled students to apply their content knowledge to the project more easily. At the school, teachers frontload all of the content, so students are exposed to it before the PBL cycle begins. The Buck Institute trainers did not encourage frontloading and recommended exposing the students to the content for the first time through the project. The principal felt students come up with better "driving and

branching questions" when content is frontloaded. Additionally, while voice and choice was a component of the Buck training, the teachers perceived driving questions in the Buck model to be teacher created instead of student created. According to the assistant principal, the school "passionately believes" in voice and choice throughout the entire project. The media specialist believed the Buck Institute would say "Here's our project, let's all make airplanes" which does not allow for uniqueness in projects. The assistant principal referred to the struggle of merging the two philosophies:

> We had a lot of discussion and probably a little bit of frustration because our philosophy differed somewhat than theirs did. And I think we, for the other teams that didn't know as much and didn't have as much background knowledge, they love the comfort of setting the direction, setting the learning target, setting how they were going to learn it, and they weren't as concerned about the voice and choice because they hadn't done the work ahead. So that was actually a comforting thing for them, whereas for us, it was a very distressing thing. Because we loved a lot of the tools and we loved a lot of the methodology but we didn't want to limit our kids in where they could go with a project.

The school believed in voice and choice throughout the entire project including formulating driving questions, conducting research, deciding how to present their learning, and the type of final product. Interestingly, students using the Buck Institute model may have the same driving question, conduct research from the same sources, and have the same final product, which shows that students at this school have more opportunities for choice. The training provided opportunities for staff members to learn more about other PBL philosophies.

After the training, team members brought back their knowledge of PBL and led professional development to the rest of the staff. Buck team members spent a year redelivering

the content to other staff members merging what they learned through the Buck Institute to their previous knowledge. The team decided to copy the Buck model for redelivery by creating vertical teams to conduct a yearlong study of six of the essential project design elements. Each team consisted of a teacher from each grade level led by members of the Buck Institute team. Each team was the expert on their content. By structuring the training in this way, there was an expert on each grade level team for each of the essential project design elements. Teams were required to "go public" with their research and share implications for students with other staff members. Team members felt redelivering the Buck training was important to get consistent PBL implementation in kindergarten through fifth grade.

In addition to the Buck training, team members discussed other opportunities that led to the fidelity of PBL implementation across all grade levels. The fourth grade teacher referenced an eight-hour technology training over the summer where she learned how to infuse technology into PBL. The art specialist referenced a cluster PBL vertical team that has had a significant impact on her ability to implement PBL effectively. In addition, the administration provides each grade level four release-planning days during the year where they develop their four required PBL units.

As PBL implementation became more widespread throughout the building, the inquiry team began implementing Opportunities with Learning (OWL) lessons. The media specialist described OWL lessons as "job imbedded professional learning. It means that the teacher usually hasn't heard it before either. So she's getting the information at the same time as the kids." The inquiry team (art teacher, media center specialist, and technology specialist) delivered OWL lessons to students and teachers simultaneously. Topics included script writing, research, and technology training.

The formal and informal training received by staff members played a significant role in helping deliver PBL with fidelity. The emphasis on inquiry and the PBL professional development staff members received led the researcher to do a case study at the school because teachers have had significant exposure and training in PBL.

According to Starman (2013), qualitative research emphasizes subjective experiences and the meanings they have for individuals. Case (1995) claims, "Qualitative researchers have pressed for understanding the complex interrelationships among all that exists" (p.37). Individuals in the study described their PBL experiences and its impact on student outcomes. In this exploratory case study (Yin, 2013), purposive sampling was used because the teachers and administrators had been through extensive PBL training through the Buck Institute and other opportunities. Starman (2013) wrote case studies are commonly used in "social sciences" and can be "valuable in practice-oriented fields such as education" (p.29). Campbell (2014) noted case studies explore a "program, event, activity or process of individuals" (p.3). This case study analyzed how staff members think and feel about project-based learning's impact on student outcomes (Simons, 2009). The study explored the "how or why" questions with the researcher having "little or no control over behavior events" (Yin, 2013, p.2).

According to Stake (1995) researchers "typically orient to cases or phenomena, seeking patterns of unanticipated as well as expected relationships" (p.41). This method allows for a study of an exploratory nature. While models and variables would be available from assessment data about the effectiveness of PBL, this particular study focuses on the perceptions of PBL.

As the intent of the study "affects what methods are chosen to gather data" (Simons, 2009, p.3), the study seeks to explore PBL's effect on elementary student outcomes. Interviews, observations, and artifact reviews helped the researcher "interpret the case" (Stake, 1995, p.114).

The researcher explored the effect of PBL on elementary students with veteran teachers who had at least three years of PBL experience.

Project cycle.

PBL occurs school-wide, but project cycles vary from grade level to grade level. Students in the lower grades typically had shorter projects (one to two weeks) and required more teacher support. Students in the upper grades had longer projects (two to three weeks) and larger blocks of time during the day to work on projects (two to three hours per day). Teachers in all grade levels spend the first 20 days of the school year preparing students for projects. Teachers conducted mini-lessons on 21st century skills, previewed project-planning documents, provided technology training, and created ground rules and norms. Many teachers conducted "mini-inquiries" to prepare students for extended projects. When students were in a project, the first five minutes and last five minutes of the project block were set aside for group members to review planning documents, their plan, and discuss progress. Teachers called this time the "First Five/Last Five." Teachers reviewed expectations for the First Five/Last Five during the first 20 days lessons and revisited them throughout each project. The first 20 days were imperative to set up routines, procedures, and expectations.

School personnel believed in frontloading content. The county curriculum map outlined the time teachers spend on each unit. School personnel aimed to frontload content to build in time for projects. If a unit on the curriculum map normally took six weeks, teachers frontloaded the content through lecture and traditional measures in three weeks and allowed the remaining three weeks for PBL. Students applied the frontloaded content into their projects and conducted additional research to extend their learning. Teachers administered formative assessments throughout the frontloading and PBL time to assess student understanding of the content.

Projects at the school started with a driving question related to the standards. Sometimes driving questions were teacher selected and other times student selected. Typically, teachers selected driving questions at the beginning of the year and as students became more comfortable with the PBL process, they gained more freedom in selecting the driving questions as the year progressed. In the lower grades, all students in a class had the same driving question. In the upper grades, students typically created two to three branching questions aligned to the teacher created driving question. After teachers and students created driving and branching questions, the students began the research phase. Students sought answers to their questions through investigations, online research databases, magazines, books, interviews with experts in the field, and videos. Students created a final product and presentation assessed by the teacher. Final products and presentations aimed to answer the driving and branching questions and included information gathered during the research phase.

This study included student presentations from kindergarten, second, fourth, and fifth grade. Kindergarten students worked on a community helper project where they created a building that represented something from their community. In second grade, students studied nonfiction text features and conducted a research project where they created a book to display their learning. Fourth grade students created branching questions about the driving question related to ecosystems. In fifth grade, students created projects about westward expansion.

Sampling.

The researcher investigated PBL with teachers who had previous experience with project-based learning (See Table 2.3).

Table 2.3.

Participant Demographics Matrix

Participant	Sex	Ethnicity	Years in Education	Years at Current School	Highest Level of Degree	Current Grade Level
Participant 1	Female	Caucasian	10	9	Bachelors	Fourth
Participant 2	Female	Caucasian	35	9	Specialist	Principal
Participant 3	Female	Caucasian	20	9	Specialist	Assistant Principal
Participant 4	Female	Caucasian	4	4	Bachelors	Kindergarten
Participant 5	Female	Caucasian	21	9	Masters	All
Participant 6	Female	Caucasian	20	9	Specialist	All

"Inclusionary criteria" required teachers to have a minimum of three years of previous PBL experience, attended the Buck Institute training, and implement a minimum of four projects per year in their classrooms (Robinson, 2014, p.26). The researcher purposefully selected teachers who attended the Buck Institute and invited the teachers to be a part of the study (Merriam, 1998). Purposive sampling ensured teachers met the three-year experience (with PBL) requirement and attended the Buck Institute training. Thus the researcher invited six teachers and two administrators to participate in the study through an e-mail invitation after IRB approval from the university and school district. Six participants agreed to participate in the study. Five out of the six participants had been at the school since its inception and knew the culture, mission, and vision. The sixth participant worked at the school four years and was included in the training because of her willingness to try PBL and ability to lead training to other staff members. The administration required teachers to fill out an application to take part in the Buck

Institute training to ensure teachers were dedicated and able to serve in leadership roles with other staff members after the training. Administrators selected teachers capable of implementing PBL and leading staff development effectively. Due to their extensive exposure with PBL and the limitation that includes only the most experienced PBL teachers, the identified participants were the most effective in helping best "understand the case" (Stake, 1995, p.56) and PBL's influence on student achievement, engagement, and inquiry and reflection. The administrators selected applicants willing to try PBL, open to leadership opportunities, and staff members that represented a variety of groups in the school. When analyzing the results of the study, one should note that the range of PBL implementation in these classes varied. The researcher selected two administrators because they have been at the school since the inception of PBL and have helped shift the pedagogy from traditional methods to PBL. In addition, both administrators attended the Buck Institute training with the teachers.

Data.

Data collected through observations, interviews, and artifact reviews helped the researcher explore teachers' perceptions of student outcomes when implementing PBL. The researcher implemented data	**Participants**	**Interview Questions**	**Observations**	**Artifacts**

collection methods to align with the guiding questions (see Figure 2.1). **Research Questions**				
How does PBL affect student engagement?	Admin.	Question 7		
	Teachers	Question 4b & 7	How did the teacher ensure students were engaged during student presentations?	Teacher conferring notes and project documents
	Researcher/ Students		What are students saying/doing that would suggest they were engaged throughout the project? Does any evidence suggest final product aligns to student interests? What evidence suggests audience members were engaged in the presentation?	
How does PBL affect student inquiry?	Admin.	Question 8		
	Teachers	Question 4d & 7		Student drafts/revisions of driving questions Student research documents
	Researcher/S tudents		How did students describe the inquiry process throughout presentations?	
How does PBL affect student reflection?	Admin.	Question 9		
	Teachers	Question 4e & 7		Student written reflections Self and Peer Assessments
	Researcher/ Students		Did students discuss challenges or outside experts?	
	Admin.	Question 5 & 10		
	Teachers	Question 4, 6, & 9		Written reflection

How does PBL affect student achievement?	Researcher/ Students		How are students able to articulate their learning through presentations?	

Figure 2.1. Research Questions Leading to Data Collection

Triangulation ensured the data remained unbiased. In addition to observations, interviews, and artifact reviews, the researcher wrote memos during and after each interview and classroom observations. During data analysis, the researcher documented emerging themes.

Interviews.

Interviews provided the teacher and administrator perceptions of PBL's effectiveness. Initial interview questions were created to gain information about the background of the participants and school (see appendix A & B). Additional interview questions aligned to the guiding questions. A peer review took place after the initial development of teacher and administrators interview questions. The researcher made modifications to interview questions based on feedback from the peer review and recommendations from the advisor.

Two administrators and four teachers agreed to participate in the study. The researcher scheduled administrator interviews first to gain insight into the background of the school, learn about PBL implementation over time and the staff development offered since the school's inception.

Two rounds of teacher interviews occurred after classroom observations. The first round of semi-structured interviews included questions aligned with the guiding questions (see Appendix B). The researcher gained information about the background of the teachers, classrooms, and school. Through a stimulated recall approach explained further in the artifacts section, teachers used student and teacher artifacts to help them remember and discuss all phases of the project. This gave the researcher insight into PBL outcomes related to inquiry, reflection, achievement, and engagement. The second round of interviews consisted of follow-up questions

based on the classroom observations, which led to insights about PBL's impact on specific students and groups.

A transcription service entitled Cogi transcribed all of the interviews. After transcription, the researcher reviewed the transcriptions and sent them to the participants to ensure accuracy. No participant requested modifications. Interviews provided valuable insight into the perspective of teachers and administrators.

Observations.

In addition to teacher and administrator interviews, classroom observations provided an additional data source. Classroom observations were valuable to see the interactions of teachers and students and provided insight into PBL's impact on student outcomes. The researcher observed student presentations with the four teachers' students. Observations lasted no more than one hour each. During student presentations, the researcher wrote analytic memos. Memos from observations were included in analytic coding. The researcher observed kindergarten, second grade, fourth grade, and fifth grade presentations. The kindergarten observation took place the collaboration space, a room dedicated to PBL on the kindergarten hallway. The room consisted of movable furniture and supplies for students to create final products. Second grade presentations took place in a conference room with the art teacher. Small groups of students presented projects to the art teacher one group at a time. The fourth grade observations took place in the fourth grade hallway through an interactive museum. Students and teachers had the opportunity to visit student exhibits and listen to a short presentation from each group. Fifth grade presentations took place in the media center using an interactive smartboard. The researcher took pictures of student final products and de-identified writing samples to use in

future analysis. Due to time constraints, observations were limited to one hour per class and only captured the final phases of the PBL process.

Artifacts.

The researcher used artifacts to facilitate a process called stimulated recall which helps delve into teachers' thinking about PBL through (Calderhead, 1981). For purposes of this study, teachers used artifacts during interviews. The researcher asked teachers to collect low, medium, and high student work samples throughout the project. Teachers' artifacts included teacher and student conferring notes, planning documents, driving question drafts, research notes, reflective writing samples, rubrics, and final products. Teachers brought artifacts to the interviews to review throughout the interview process. Teachers referenced student work to recall information relevant to the interview questions. The artifacts served as a tool for teachers to recall information from all phases of the project. Due to the length of projects, artifacts were valuable to help teachers remember all phases of the project as well as success stories and challenges of specific students or groups. In addition, the researcher reviewed student artifacts independently. Student artifacts included planning documents, driving/branching question drafts, research documents, student final products, class anchor charts, student created books, and electronic portfolios. The document analysis provided an in-depth look at student questions, research, and student knowledge about the topics.

Data analysis.

Stake (1995) claims in doing research, one is searching for "patterns or consistencies" (p. 44). The researcher coded interview transcripts, field notes, memos, and student artifacts. NVivo software helped analyze data to identify emerging themes. The researcher developed initial codes

from definitions of engagement, inquiry, reflection, and achievement from the literature (see *Figure 2.2*).

Major Code	Initial Sub Codes	Sources
Engagement	Motivation, relevance, student involvement in decision making, authenticity, collaborative decision making	Kaldi, Filippatou, and Govaris (2011); Larmer and Mergendoller (2015); Kaldi, Filippatou, and Govaris (2011),
Inquiry	Student driving questions, research to solve questions, planning and designing experiments, collecting data, and providing explanations	Capps and Crawford (2013); Larmer and Mergendoller, 2015
Reflection	Students thinking about work, refining product, new ideas, thinking about learning, why their learning, thinking about processes	Larmer & Mergendoller (2015); Berger (n.d); Blumenfeld et al. (1991)
Academic Achievement	Academic content, academic skills, problem solving, critical thinking, mastery of standards	Armstrong (2006)

Figure 2.2. Initial Codes

During first cycle coding, the researcher coded transcripts that fit with the definitions of student engagement, inquiry, reflection, and achievement (Saldana, 2016). As codes developed, the researcher created additional sub codes for further analysis (see *Figure 2.3*). Creating additional sub codes enabled the researcher to analyze the data more precisely.

Major Code	Original Sub Codes	Additional Sub Codes
Engagement	Motivation, relevance, student involvement in decision making, authenticity, collaborative decision making	Encouragement, enjoying learning, confidence, on-task, relevance, ownership, authenticity, making connections, excitement, audience, eagerness to share, sounds and comments, changes in environment, interest, focus, on-task behavior, outside of school, student comments, topic, leadership, student focused, energizing, higher engagement, encouragement, enjoying learning, confidence
Inquiry	Student driving questions, research to solve questions, planning and designing experiments, collecting data, and providing explanations	Learning from students, specials, research to solve questions, planning and designing experiments, challenges, excitement, providing explanations, culture of inquiry, questions lead to questions, during presentations, student wonders, student choice, modeling, encouraging questioning, supporting teachers, pathways, collaborative planning, quality research, pathfinder, collecting data, accountability, student driven questions, structure, evolving, risks, purpose, branching questions, quality, differentiated, development, aligned to standards, student supports, ground rules, focusing on processes, flexibility, creating groups, creating a plan, clear focus
Reflection	Students thinking about work, refining product, new ideas, thinking about learning, why their	Tools, through presentations, improving quality, final product, refining product, rough draft, from feedback, continuous, teacher processes, student processes, rules and norms, gradual release, first 5 last 5, consistency, conferring, branding, roles, ratings, project plan, presentations, checklists, benefits, discussion and

	learning, thinking about processes	debate, thinking deeper, thinking about content, teacher role, rubrics, new ideas, misconceptions, teacher support, connecting driving questions, challenges, time, refine reflection, original thinking
Academic Achievement	Academic content, academic skills, problem solving, critical thinking, mastery of standards,	Types of students, struggling, special ed., high students, gifted, differentiation, different learning styles, average students, all students, weighted school assessment, reading levels, Georgia Milestones, district assessments, classroom assessments, teamwork, process, problem solving, critical thinking, 21st century skills, collaboration, vocabulary usage, understanding, synthesize thinking, mastery of standards, making predictions, making connections, frontloading, end product, challenges, getting off the standard, frontloading, conferring, beyond the standard, plagiarism, misconceptions, collaboration

Figure 2.3. Research Codes

During second cycle coding, the researcher analyzed first cycle codes to examine them as "dimensions of categories" (Saldana, 2016, p.108). The researcher synthesized the data by refining codes that fit into larger themes. Deleting isolated codes that did not fit into the larger themes enabled the data to help tell the larger story of PBL at the school. The researcher wrote analytic memos during first and second cycle coding to analyze ideas, capture insights, and connect to disparate thinking. This enabled the researcher to clarify ongoing assumptions about PBL implementation (Bloomberg & Volpe, 2012). In addition, coded artifacts provided the perspective of students. Coding enabled the researcher to find emerging themes among the triangulated data.

According to Stake (1995), "The researcher should have a data storage system. For many researchers, the most important thing is to have a personal diary or log in which everything is kept: calendar, phone numbers, observation notes, expenses" (p.55). The researcher deleted interview recordings immediately after transcription and the flash drive where the transcriptions are stored was password protected and stored in locked cabinet in the office of the researcher to ensure confidentiality. The researcher and principal of the researcher's school are the only people with access to the cabinet. A second copy was stored on a password protected external hard drive in the home office of the researcher.

The researcher used member checking to have the participants examine the transcripts when no other data needed to be collected from the participants (Stake, 1995). The researcher asked participants to review the transcripts for accuracy.

Trustworthiness.

Other measures helped ensure the study was ethical, participants protected, and the findings reliable. In qualitative research, credibility, dependability, and transferability help ensure the research is trustworthy. The researcher made a conscious effort to ensure the research was trustworthy throughout the entire study.

Bloomberg and Volpe (2012) wrote that credibility refers to "whether the participants' perceptions match up with the researcher's portrayal of them" (p. 112). The researcher in this study taught elementary school using PBL, which may present a biased view. Before this study, the researcher was a proponent of PBL based on personal experiences in the classroom. Throughout the process of data collection and analysis, the researcher monitored his bias by recording reflective field notes during the research process and monitoring the notes closely to ensure the results reflected participant beliefs and not the researcher's bias. In addition, triangulation helped the researcher ensure data was gathered from multiple sources. The researcher used multiple methods to collect data and analyze emerging themes (Campbell, 2014). This study is credible as triangulation helped ensure the data was not skewed due to singular method of data collection (Merriam & Tisdell, 2016; Stake, 1995). Interviews, artifacts, and observations helped the researcher compare data sources to ensure themes were present in multiple sources of data. Stake (1995) believes "Researchers are interventionists. They try to see what would have happened had they not been there" (p. 44). As a result, the researcher made every effort to bring little to no attention to himself during fieldwork. The researcher made

interpretations in the field, observed, and synthesized the research (Stake, 1995). With this in mind, one researcher conducted all of the interviews, reviewed the transcripts, and coded the data. The phenomenon in the study was not manipulated and the participants were evaluated in their naturally occurring environment (Dasgupta, 2015). The researcher involved the perspectives of classroom teachers, support teachers, and the administration to gain a diverse perspective.

The study bore minimal risks to the participants both physically and psychologically. At the beginning of the study, the researcher informed participants that participation was voluntary and reminded them that data was confidential at all times. In addition, the researcher informed participants that pseudonyms would protect their identity. The researcher did not identify the school, county, or state where the study took place. The researcher used member checks by having participants review rough drafts of transcripts and findings to ensure participants' perspectives were portrayed accurately. No participants disputed the drafts. These measures helped the researcher ensure his own bias remained minimal throughout the study.

According to Bloomberg and Volpe (2012), dependability "refers to whether one can track the processes and procedures used to collect and interpret data" (p. 113) The design of the study allowed for as much authenticity as possible. This aligns with the social constructivist theory as Creswell (2013) claims the goal of research is to rely as much as possible on the participants' views of the situation. The study is easily replicable to other settings, populations, or situations due to the descriptions in the context, methodology, analysis, and findings sections. In addition, this study is dependable due to the consistency used by the researcher in data collection and analyzation methods. The researcher is open to sharing the qualitative data for review by other researchers upon request.

Bloomberg and Volpe (2012) wrote that transferability refers to "the fit or match between the research context and other contexts." Rich descriptions included background information about each participant, staff training related to PBL, and a thorough description of the background and setting of the school. The researcher used participants' quotes throughout the findings and discussions sections to provide a "thick description" (Denzin, 2001). Rich descriptions throughout the methodology, research context, and data sections enable others to duplicate the study easily. This study is easily transferable to other research contexts.

This study is trustworthy because of measures taken by the researcher related to credibility, dependability, and transferability. Researchers such as Lincoln & Guba (1985) believe trustworthiness should be evaluated by its credibility, dependability, and transferability. The researcher took significant measures throughout the duration of the study to ensure the study was trustworthy.

Findings

This dissertation examines teacher and administrator perceptions of PBL's effectiveness on elementary student outcomes. The findings section is organized in alignment with the three guiding questions:

1 What is the perception of teachers and administrators with regards to PBL's effectiveness on student engagement?

2 How do teachers and administrators describe the impact of PBL on student inquiry and reflection?

3 What is the perception of teachers and administrators on PBL's impact on student academic achievement?

This section outlines the research findings after analysis from interviews, observations, and artifacts. Subheadings of student engagement, inquiry, reflection, and student achievement provide the structure to the findings section. For each subheading, findings are discussed in detail.

Student engagement.

The literature review outlines work from previous research to define engagement for this study. For purposes of this study, engagement includes motivation, relevance, student involvement in decision-making, authenticity, and collaborative decision-making (Filippatou & Kaldi, 2010; Kaldi et al., 2011; Larmer & Mergendoller, 2015). During coding, sub codes under motivation included confidence, encouragement, enjoying learning, excitement, and on-task behavior. Subcodes under relevance included ownership, making connections, and authenticity. Subcodes under collaborative decision-making included student roles, solving problems, formulating groups, collaboration lessons, challenges, and accountability. Subcodes under student involvement in decision making included voice and choice, teaching adults, project design, independence, evolving choice, challenges, and buy-in. The findings in this section relate to the aforementioned sub topics.

PBL changes student engagement.

Administrators and teachers noted changes to student engagement due to PBL implementation. Teachers noted students seemed more engaged during project time than the frontloading period. Teachers perceived PBL to be more student focused than traditional instruction and noted higher levels of engagement because of PBL implementation. The kindergarten teacher stated PBL brought an “energizing” type of engagement that differed from engagement before PBL implementation. The principal said visitors are commonplace in the

building and are usually "blown away by the level of engagement and on-task behavior during a PBL unit." Staff members at the school believed student choice is a critical component of engagement. PBL allows students to engage with their own wonderings and questions, which makes learning meaningful and leads to higher levels of engagement. During interviews, three participants stated since the beginning of PBL implementation, the biggest difference has been in student engagement. The fourth grade teacher stated that engagement through PBL has resulted in "better students" as students demonstrated more on-task behavior during projects.

Another motivating factor tied to engagement is relevance to the students. Teachers felt learning was meaningful when students had ownership. In PBL projects, offering choice increased students' motivation. The kindergarten projects related to community helpers and buildings in the local community. Students enjoyed talking about the buildings and community helpers they see in the town. Student choice played a role in making projects relevant for the kindergarteners. Students designed buildings in the local community of their choice. Some students chose McDonald's because they "like their french fries." Others chose Toys R Us because they "love their toys." In fourth grade, students had the opportunity to write branching questions that stemmed from the overarching driving question, which was "How do changes in an ecosystem affect the living and non-living things that live there?" Many of the student's branching questions related to experiences in their own lives. One group's branching question related to deer overpopulation. One of the group members brought in antlers from a deer he hunted a few weeks before the start of the project. The students' research led them to find information related to deer overpopulation and the number of car accidents deer cause each year. The group advocated for controlled deer hunting in certain areas because of the personal connections they had to the topic. The art specialist stated, "I like the authentic piece. So much of

my joy comes from this position. I am seeing their story and it's not because we told them what their story is. It's because they're choosing it." When projects were relevant to students, engagement increased.

Relevancy involves giving students opportunities to have a voice in the project. Throughout the projects at the school, students had many opportunities to make independent decisions . Across the school, students typically had a voice in the branching questions, research methods, final products, and presentation methods. The art specialist believed giving students input into decisions increased buy-in and helped students become "more energetic and engaged." During presentations, students shared why they selected their branching questions. Students made comments such as "We selected this because we were fascinated with the injuries of the workers" or "We picked lighthouses because we love the beach." As students got older, voice and choice became more prevalent. Students in the younger grades needed more scaffolding in formulating questions and conducting research. Additionally, teachers commented that as students became familiar with the PBL process they had more opportunities for choice. As the year advanced, projects became more student centered.

During classroom observations, the majority of audience members in all grade levels appeared focused during presentations, a sign of student engagement. In kindergarten, students in the audience frequently nodded their head and asked questions at the end of presentations. During fifth grade presentations, the teacher gave audience members an opportunity to ask two questions to each group. Nearly every audience member raised their hand with a question after each group presented. Some students referred to notes they took during student presentations and asked questions related to their wonderings. Sometimes students found contradicting information. During one presentation, a student asked, "Where did you get your information?

Because it is very interesting how you got $25 per person and we found $35." This led to a class discussion about the importance of using valid resources because of the engagement of audience members. The kindergarten teacher said PBL helps students focus at higher levels "throughout the entire project and presentations."

Participants noted that parents frequently commented about their students' level of engagement at home as well as school. In fourth grade, every student had a Google Docs account accessible from home or school. Students frequently researched from home and sent messages to group members and teachers after school. Students were not required to work from home but did because of their engagement with the project. Other students practiced at home by creating mock presentations to become more familiar with technology tools so they could utilize them more effectively with their group members at school.

Staff members perceived PBL as a motivating factor for students because it provided more leadership opportunities than traditional instruction due to the significant amount of time working in groups with other students. The assistant principal claimed, "Non-leaders are becoming leaders" because of opportunities to work with others during projects. During one project, a group of students with strong personalities worked together and demonstrated negative leadership qualities. The principal stated at the beginning of the project, students were "bossy and didn't listen to each other." Throughout the project, the students learned how to get along and eventually worked through their differences. The principal believed it was "a lesson for them" and "they have become leaders in a positive way." The assistant principal said, "I have seen leadership, self-motivation, and self-directed learning come out that maybe you wouldn't see as much of in a traditional classroom model."

Another change in engagement related to the confidence students exhibited as participants felt students were not afraid to try anything. The principal said, “They all think they’re Einstein just because they… just, the confidence they exuberate.” PBL allowed students to develop their strengths. One student developed the nickname “the coding kid” because of hours of coding practice. The principal said a parent stated, “I’m not real sure what you're doing over here. But for the first time, my daughter comes home and is bubbling about school.”

Teachers claimed PBL helped students enjoy learning. The art specialist believed that during projects, students were “energetic, louder, and excited to share their learning.” When the kindergarten teacher asked one of the students to present, the student jumped off the floor and ran to the front of the room smiling. In fourth grade, students commented during presentations that they “enjoyed” the project and “couldn’t wait” to do the next one. During a second grade presentation, one student said, “This project was awesome.” The fourth grade teacher stated that PBL “makes them (students) like school more” and “get more involved in learning.” The principal stated that students frequently thanked her for letting them do projects.

Students enjoyed working collaboratively with other group members and held each other accountable during projects. The fourth-grade teacher stated, “There weren’t a lot of kids that were goofing off, you know, their captains held them accountable and they were holding each other accountable as well.” Participants stated that students did not want to miss school during a project-cycle for fear of letting their team down. One parent told the principal that her child called to pick her up 20 minutes early from a play date because the children had been working on their project during their play date and wanted to practice the presentation for the parent.

Giving students opportunities for greater voice and choice has risks. Students at the elementary level are more likely to get off the standard with greater choice since there is less

teacher direction. Additionally, teachers had a harder time keeping up with student projects since each group had unique research questions and final products. Conferring became vital to address those challenges. At this school, students worked with experts throughout the building. Teachers had to be comfortable letting students work in collaboration spaces, the media center, or with teachers in other classrooms. Students used walkie-talkies when they went to other parts of the building so that their teacher could communicate with them at all times.

Another challenge arose from the collaborative process in which students' different work styles had to meld. Teachers talked about the importance of embedding explicit collaboration lessons at the beginning of the year and revisiting them throughout each project. Lessons ranged from learning how to disagree agreeably to modeling how to use a project outline to keep students focused. In addition to collaboration lessons, students created groups norms and held each other accountable to them.

Sometimes, PBL brought out negative leadership qualities in students. During presentations, students spoke of challenges related to decision making. One second-grade group talked about the challenge of making a decision on what presentation aid to use. Some students wanted to make an electronic presentation while others wanted a tangible final product. These disagreements stalled work on the project until the students were able to resolve their differences. The principal spoke about a group of fifth graders with group members that had dominating personalities. The group members had such a difficult time agreeing on their project that they ended up in the principal's office. This required support from the teacher and administration to help students work through the negative leadership qualities exhibited by students.

While most students enjoyed collaborating with their peers, some students preferred working alone which lead to challenges with group dynamics. During presentations, students talked about the challenge of working with group members who disagreed with their approach or opinion. Participants said some groups have a hard time coming to a consensus and need teacher support to move forward. Other students had disagreements over whose turn it was to use the technology available to them. Despite these challenges, participants overwhelmingly agreed that PBL has a significant impact on student engagement.

PBL affects engagement for a variety of subgroups.

Participants believed PBL was beneficial for all students and had different views about which students it affected the most. Some participants believed PBL has more impact on girls than other subgroups. Others believed high-achieving students benefited the most because of the differentiation opportunities it afforded. Others believed it helped disengaged students because it allowed them to connect their personal interests with the content.

Several of the participants believed PBL had a positive impact on girls. One of the girls that attended the school is now a high school student and worked with companies on a marketing plan for a patented product that she created. Another group of girls worked with an Atlanta soup kitchen to donate food during a project about The Great Depression. The project was so successful they continued it into middle school. The school had an all-female robotics team that competed on the school's behalf. According to the assistant principal, females "have really thrived" in PBL as it offers opportunities for "leadership, organizational structure, self-motivation, and self-directed learning" that girls may not have experienced without PBL.

PBL may be beneficial for high achieving students due to the differentiation opportunities it provides. The assistant principal believed gifted learners "thrive" in a PBL environment

because of the challenging nature of projects. Teachers modified projects to challenge gifted students and allowed them to pick topics of interest. The district office partnered with the school to offer training on the school's gifted pullout model. The principal stated PBL had a positive impact on "those high flying kids." One benefit to high achieving students is that they were required to depend on others who have different opinions. The principal stated, "It's helped them to become a little more humble so that they are listening and just, because you don't make the A on your paper it doesn't mean that you don't have something to contribute. It allows them to value every person on their team." In this way, PBL broadened students' perspective and helps them understand the value in others' perspectives.

Another subgroup positively impacted by PBL was disengaged students. The kindergarten teacher stated, "PBL is good for attentional or behavioral students" because it helped them connect the content with their interests. The fourth grade teacher believed boys who are normally disengaged from school were "more engaged" due to the opportunity to select a topic that interested them. The assistant principal stated, "Kids who can't research disengage." This appeared true during the research phase when students spent time reading articles related to their topic. Students that struggle with reading benefited from PBL due to the opportunities they had to learn using research tools (videoconferencing, interviews, and videos) that did not require reading. The school assisted struggling researchers with scaffolded support and differentiated research materials. While the kindergarten teacher felt that "attentional challenges kind of diminished because they have some say in what they are learning about." Both she and administrators noted that frequent check-ins were required to ensure the learning aligned with the content.

Presentations increase student engagement.

Teachers required students to present projects to a public audience. Students frequently presented projects to classmates, classes on other grade levels, community members, and parents. Presentations occurred at various locations in the school building. For this project cycle, fourth grade students presented in the hallway, fifth and second grade students presented in the media center, and kindergarten students presented on the grade level collaboration room. Student presentations had many positive benefits including increased student engagement. Students enjoyed learning from their peers during presentations. Throughout presentations, students in the audience appeared engaged and asked questions related to the information presented. Each project had different branching questions, which made each presentation unique and engaging. Teachers commented that the variety of each project helps students stay engaged for longer periods. The art specialist, for example, stated the length of time students are engaged has "been the biggest difference" since the beginning of PBL implementation. Additionally, the fourth-grade teacher stated, "They're definitely more engaged in school [during PBL]." Students enjoyed learning from one another during presentation day. Most presentations lasted 5-10 minutes with an opportunity for audience members to ask questions at the end. Students were interested in the final products and asked questions such as "How did you build that?" and "Why did you decide to design your Pictochart like that?"

The majority of questions were thought provoking and aligned to the content standards. Most group members answered questions accurately and articulately. Group members and audience members engaged in lively discussions about each project. Some groups had questions geared towards audience members to engage them in the presentation. Students received instruction from their teachers leading up to the presentation on strategies to engage the audience. Strategies included visual aids, assigned speaking parts, choral reading, introductions,

and engaging questions directed at specific audience members. The fourth grade teacher stated that students were more engaged throughout the entire project because they knew they were responsible for presenting their information to their peers during presentation day.

Going public with student work was commonplace in the school and served as a motivating factor for students. Teachers claimed excitement was very high in the building in the two weeks leading up to student presentations. In fourth grade, students presented to children in other classes. Staff members stopped by the fourth grade hallway to see student presentations. Presenting to an outside audience appeared to serve as a motivating factor for students. During presentations, audience members frequently made comments such as "good job" and "bravo, bravo." Students celebrated one another's successes. Even kindergarteners complimented one another's projects with comments such as "that's a really good house" and "your project is very interesting." During kindergarten presentations, the teacher asked students to explain a two dimensional map that the class created together. One hundred percent of students raised their hands to share what their role was in the development of the map. At this school, displaying and celebrating final products served as a motivating factor to students.

At this school, PBL had a positive impact on student engagement. The teachers perceived students to be more engaged throughout a project than traditional instruction. Due to time constraints, the researcher only observed student presentations; however, students in each grade level could articulate all parts of their project indicating their engagement throughout the entire PBL cycle. PBL affected a variety of subgroups at the school; particularly girls, boys, high achieving, low achieving, and disengaged students. Student engagement increased due to student presentations at the end of a project cycle. If implemented appropriately PBL has the potential to increase student engagement.

Inquiry.

The literature review outlines work from previous research on inquiry in PBL. For purposes of this study, inquiry relates to student driven questions, research to solve questions, planning and designing experiments, collecting data, and providing explanations (Capps & Crawford, 2013; Larmer et al., 2015). Sub themes provide greater insight into the perception of inquiry in PBL at the school where the study takes place (see table 2.5).

Culture of inquiry.

Participants stated that inquiry has been a part of their student's education since the beginning of kindergarten. Students were encouraged to question in all subjects and all parts of the day. Teachers encouraged students to think deeply and question frequently. The fourth grade teacher stated, "They're (students) trained to inquire and wonder about everything." This has happened through explicit teaching and teacher modeling during think-alouds. Teachers often paused during read-alouds or video clips to share their own wonderings with students. Teachers found students mimicked this inquisitive approach. Inquiry lessons began in kindergarten and continued through fifth grade. Students documented questions, researched, and recorded "I wonders" in PBL notebooks, I wonder charts, sticky notes, and graphic organizers. In kindergarten, a wonder wall included questions such as who, what, when, where, and how. As students had questions about a topic, the teacher documented them on a wonder wall. As questions got answered, the teacher recorded the answers with a different colored marker on the chart. This intentionality lead to a culture of questioning. The media specialist stated, "It's (wonders) very important to them now, because that's what they do all the time. If anything, it's hard to stop them from wondering." Participants believed students' ability to inquire increased over time due to school-wide intentionality.

Participants believed inquiry was an essential component of PBL. As students found answers to branching questions, it lead to additional questions. This required additional research and a cycle was born. Student questions lead to more questions requiring extensive research. The ongoing research cycle lead to student learning. By encouraging students to question, teachers allowed students the opportunity to investigate their wonderings through research relevant to the individual. In kindergarten, teachers conducted "mini-inquiries" based on student wonders. When students had questions, teachers did not always move through the entire PBL cycle, but conducted class research to find answers to mini-inquiries. Sometimes these mini-inquiries were the beginning of a larger project.

Students inquired with classmates and learned from one another. Working in groups allowed students to share wonderings with group members. Students did not always find the answer to their questions, but their pursuit of the information lead to learning. During presentations, audience members were eager to ask questions. In some groups, audience members' questions led to deeper thinking. One student asked, "What would happen if sea otters were removed completely from an ecosystem?" The group members used their background knowledge and made a probable explanation to answer the audience member's question. Students at the school enjoy "doing inquiry" with other classmates. One student told the art specialist that they could not wait to do inquiry again because "It's the funnest (sic) thing to do in school besides recess!" Staff members at the school believed children were naturally inquisitive; however, they also believed curiosity could be stifled at an early age. Teachers believed their role was to encourage student questions and curiosity.

Supports needed for the Inquiry Process in PBL.

Students and teachers needed support during PBL. Students had difficulty learning and applying the inquiry process and finding quality research materials. Teachers needed support keeping student wonderings aligned with the standards. At this school, teachers and students benefited from support from others.

Students had difficulty learning the inquiry process, asking questions aligned to the standards, staying on topic, documenting their learning, and synthesizing research. Students had difficulty finding quality research materials that helped them answer driving questions. In addition, students occasionally got off-topic when they found interesting information, even if it did not align with the driving question. Teachers played an important role in ensuring student wonders aligned with the driving question. Much like a research study, the structure of PBL played an important role in the quality of the research and final product. In the beginning of the year, teacher directed PBL's were more common. Participants stressed the importance of students understanding the PBL process over a flashy final product. Teachers stated teacher modeling played a large role in helping students create quality driving questions and research valuable information. As students became familiar with the process, they had greater opportunities for voice and choice in a project. Projects became more student centered as the year advanced. In addition, PBL evolved since its inception in the school. The principal stated,

> When we first started we were a little more open to whatever the kids wanted to research within that time period, or that unit, or that topic and we let them. And we'll do that as we move forward in the school year. But we start out a little more controlled to make sure that they have not only the process of what we ask them to do, but the level in which we want them to produce.

Staff members at the school valued the process over the final product.

At this elementary school, the driving question was the centerpiece of the project. The principal stated, “We have found even though they've written driving questions and branching questions, it gets more sophisticated each year. We have found that the better the driving question and the branching questions, the better the research, the better the project.” In the beginning of the year when students were not as familiar with the PBL process, the teacher gave driving questions to the students to ensure the research and final product aligned with the standard.

Teachers noted that one challenge of the inquiry process was ensuring that student wonderings and questions align with the standards. Administrators dedicated significant amounts of professional learning to grade level teams designing and planning projects. Each grade level team created an “inquiry outline” that included standards, the process focus, resources, and going public. Participants continually stressed the importance of teaching students the PBL process. While student questions were an important component of the inquiry process, when branching questions did not align with the standard students learned interesting information, but it did not prepare them for standardized assessments. For example, one group’s driving question was “How do changes in an ecosystem affect the living and nonliving things that live there?” Two of the three branching questions aligned with the standard, but the last one was “Why are rhinos so valuable to people?” While an interesting question , it did not directly relate to the science standard. The art specialist believed preventing this was possible through student-teacher conferences, especially in the beginning of the project when students formulated branching questions.

The principals, teachers, and students passionately believed in student choice. To give students choice in the projects, students created two to four branching questions under the

umbrella of the driving question. Some students created branching questions independently, while others needed direct teacher support. Teachers worked with groups to differentiate the number of questions and depth of questions depending on the students' abilities within the group. In 5th grade, one group's driving question was "How are homesteaders and cowboys alike and different?" The branching questions were "

1. What are the obstacles cowboys and homesteaders faced?
2. What are cowboy's daily lives like?
3. What are homesteaders daily lives like?
4. What did cowboys wear?"

These questions, much like research questions in a study, ensured student work aligned with the standards and helped teachers keep students accountable throughout the entire PBL process. To help students create branching questions, teachers conducted mini-lessons and provided examples and non-examples of researchable branching questions. Student wonders played a key role in helping students create engaging branching questions. In kindergarten, the teacher created "I wonder" charts as students built their background knowledge during front loading. These color coded charts tracked student questions and enabled the teacher to document class discussions as a reference.

Teachers frequently talked to students about the difference between questions quickly answered through a Google search and questions that would lend themselves to in-depth inquiry. In second grade, the art specialist stated at the beginning of a project, students came up with questions such as "What are wildcats?" While this type of branching question aligned with the driving question, it was not open-ended enough to lead to in-depth inquiry. Students, especially in the lower grades, needed some level of teacher support to create a researchable branching

question under the umbrella of the driving question. In the younger grades, teachers provided a bank of options in which students selected their branching question. Students in the upper grades did not need as much support. In the upper grades, each group member was responsible for conducting research for one branching question.

In order to add to the students' knowledge of the standard, it was important to have a clear focus. The driving question helped students create a clear focus. The assistant principal believed at the end of a unit that it should be "very clear" to the students what they learned. It was the teacher's role to help students stay focused on the topic throughout the entire project. Teachers built in several key components to ensure students stayed focused on the topic. In the upper grades, teachers required students to conduct a daily meeting called the "First Five/Last Five." During this meeting, students spent the first and last five minutes of their work time documenting their progress and recording how their information aligned with the standards. Students used Google Docs to save project outlines, research documents, and other important information.

Occasionally students' had difficulties understanding their research and formed misconceptions. Teachers felt this happened when students had difficulty aligning information from multiple sources with their own thinking to create a synthesis of the research. Students used graphic organizers during the research phase where they recorded notes, summary of the source, and synthesize their own thinking. Teacher modeling became important for the synthesis piece. During one presentation, students presented information about cowboys' 10-gallon hats. The audience asked the presenters about the 10-gallon hat and the students explained that cowboys used the hats to carry 10 gallons of water. The presenters had misconceptions about the purpose and actual size of a 10-gallon hat which required teacher intervention.

Another key component of the inquiry process was documenting how students plan and design experiments which many students required supports to do. At the beginning of the project, students documented how they would show their learning through a final product or presentation at the end of the project cycle. Teachers required students to think with the end in mind. In kindergarten for example, students created a plan for their project that included the lines and shapes they would add to their community building. Teachers emphasized the importance of meeting with groups daily to offer support. Some teachers invited parent and community helpers to mentor and assist groups. The structure of the PBL and teacher support played an important role in ensuring students stayed focused on the right content.

Providing a structure that met the needs of students presented challenges. Teachers had difficulty meeting with each group every day due to time constraints. In the beginning, teachers found students spent more time on the final product than they did the research phase. To resolve this issue, some teachers required checkpoints before students could move on to the next phase of the project. Teachers found it difficult to know when the project would end because it was nearly impossible to predict the amount of time students needed to research their branching questions. The art specialist believed teachers must have a "different mindset" in the midst of a project and be open to a flexible schedule to allow the inquiry process to "unfold naturally." During PBL, students required support from the teacher and teachers required support from others for successful PBL implementation.

Supports teachers need during the inquiry process PBL required significant planning and teacher support. Teachers had difficulty finding enough time to plan and prepare for PBL. The school's "inquiry team" made up of the media, art, and technology specialists, provided multi-leveled support to teachers throughout the entire PBL process through specials classes,

push-in support, and planning with teachers. The inquiry team's goal was to remove barriers for classroom teachers. This allowed teachers to focus on the content.

The first level of support provided to the teachers was direct interaction with students through inquiry specials. Each class attended one special each day (art, music, physical education, inquiry special). Classes were on a five-day rotation. One of the rotations included an inquiry special. The inquiry team had a flexible schedule to allow for flexibility during the PBL process. Inquiry teachers collaborated with classroom teachers to see what supports they needed. Typically, the media specialist conducted research lessons with students, the technology specialist provided training on new technology tools, and the art specialist worked with students on final products. In addition, the inquiry teachers provided training on 21st century skills such as problem solving and collaboration. Teachers valued these supports because they were not experts in those areas or may not have enough time to implement lessons in their homeroom. For example, the kindergarten teacher appreciated the support the inquiry specials teachers provided during the community helpers project which included the specialists "taking pictures of the community."

The principal stated teachers liked having the specials teachers in their planning meetings so they could "be a part of what the grade level is working on for the students." They depended on the inquiry team to assist them. The school had pathways taught during an additional inquiry specials, a weekly extension class all students received. According to school documents, the school defined a pathway as "a series of instructional strategies that allow for students to have success in their PBL explorations." During the inquiry special, teachers provided direct instruction on pathways which included "The Arts, Research, Video Production, Coding, Web Tools, and Engineering and Design." Pathway work was frontloaded to allow students to gain

basic research or technology skills. Students applied their learning from the pathways into their projects. In addition, inquiry teachers showed students how to write effective branching questions, collect quality research, write scripts, make movies, and use technology tools effectively. The inquiry team exposed students to new ways of "going public."

The second layer of support was push-in support. Each day, one of the three inquiry specialists taught specials classes. The other two inquiry specialists were available to push-in to assist teachers. The inquiry specialists found resources, created graphic organizers, and assisted with teacher planning to ensure the inquiry process was effective. The inquiry team had a flexible schedule to allow them to attend collaborative planning with every grade level and take part in release planning days. As inquiry specialists identified needs of grade levels, they created mini-lessons that were stored in a database. Classroom teachers had the flexibility to use the lessons with their entire class or small groups of students. Additionally, some classroom teachers requested the inquiry specialists model the lessons with their class. The kindergarten teacher spoke of "training with specials teachers" that benefited students and teachers. Having the inquiry teachers provide training to students helped the classroom teachers because it gave the students foundational skills for their final product. For example, students learned video production through the inquiry special and applied their knowledge of video editing to their projects in the classroom. The classroom teachers may not have had enough time to teach video production due to the standards they needed to address in class.

The third layer of support was project-planning support. For example, in kindergarten, teachers requested pictures of businesses and local community helpers. The inquiry specialists took pictures that teachers used to build students' background knowledge, encourage dialogue,

and create new branching questions at the front end of the project. Additionally, the inquiry specialists attended collaborative planning and release planning days with each grade level.

One of the challenges of the inquiry process was helping students access quality resources. In the beginning, students relied heavily on Google to conduct research, which led to conflicting information or content that was not age appropriate. The media specialist collaborated with classroom teachers during the planning phases of a project to create a database for student research. She created "pathfinders" that helped students locate important information in age appropriate databases. Students had access to pathfinders through an online learning platform, which increased the quality of research.

Reflection.

The literature review outlines work from previous research to define reflection for this study as student thinking about their processes and learning (Berger, n.d.; Blumenfeld et al., 1991; Larmer et al., 2015). This study focuses on the impact of reflection on the formulation of new ideas. This section focuses on the value of reflection in improving the quality of learning for both students and teachers.

Reflection improved the quality of learning.

Participants believed when students thought about their learning and work, it improved the quality of learning. Teachers noticed an improvement in student work through reflection and experience with PBL. Students used the engineering and design process to "redesign" final products and improve upon them throughout the process after reflecting upon initial designs. Students thinking about the learning improved their ability to think at a deeper level and final products.

Initially, teachers asked students to reflect upon their driving and branching questions. Sometimes students had difficulty connecting the branching questions to the driving question. Teachers played an important role in helping students reflect upon the alignment of the driving and branching questions. In fourth grade, the teacher used Google Docs to comment on student work plans and research templates. One group needed redirection to align the driving and branching questions. The fourth grade teacher wrote, "You should be talking about how the snakehead fish affects the ecosystem that it has invaded." The teacher encouraged students to reflect upon their work and make changes to better align with the driving question.

Conferring was another valuable reflection tool throughout the PBL process. Conferring helped students reflect upon the final product. In kindergarten, the teacher met with the students and discussed the final product. The teacher asked the students “What story does your final product tell?” Kindergarten students needed prompting to tell the story of their final product. Staff members felt conferring was a key component of a successful project and essential in all phases of a project. In kindergarten, one group of students’ research did not align to their driving question. As the teacher conferred with the students, she realized they were unable to answer their driving question from the research gathered. Students reflected about their work and told the teacher “We'd like to spend more time within our research to answer our questions since we weren't able to do [answer] that.” In some cases, teachers realized students did not have the necessary research to move forward with the project and had students step back to gather more information. The assistant principal stated, “We are getting more comfortable with kids ending at different points in the project if they are not mastering what they need to master at that stage of the game.” Conferring helped teachers identify where students were at in the project and helped them reflect upon their work.

Teachers spoke about the importance of asking reflective questions during teacher/student conferences. During conferences, teachers asked students to speak about the connection between the standards, their branching questions, the research, and final product. Conferring enabled teachers to ask students questions that helps them reflect and ensure that their learning aligns with standards. The principal believed effective conferring happened when teachers moved into a coach versus lecturer role. At this school, coaching required teachers to come alongside students to ask reflective questions that enhanced student learning. The principal stated, "The teacher needs to be pulling this team today and having a conference with them. Where are you at? Okay, so this is not answering that question to me. What else do we need?" She added, "What else can we research? Maybe we need to go in this direction. So really being that coach to the kids has evolved and is still evolving. But I think that's a critical piece so that it's not a free for all." Teachers encouraged students to think about their work throughout the entire PBL cycle with the questions they asked. Students reflected upon the driving and branching questions, research, final product, and presentations.

Teachers spoke about the importance of reflecting upon the final product. Students frequently created multiple drafts of final products with the goal of improving each design. The kindergarten teacher believed providing students multiple opportunities to reflect upon their final product helped the products become "purposeful rather than pretty." Teachers modeled their own thinking as they looked at student final products and shared their thinking about ways to improve the final product. The principal stated, "It [modeling] has really allowed our product to go up, way up." Across the school, students frequently created rough drafts before building models.

Creating a rough draft forced students to reflect before they were too far into the design to make changes. In fourth grade, the teacher analyzed student work plans on Google Docs and

commented in writing. Early in the project, one of the groups planned to create a stop motion film for their final product. The teacher asked the students to reflect upon the components of the stop motion. This question was key in helping the students reflect upon the content that needed to be included in the video.

One of the goals of student presentations was for students to do more than regurgitate information to their peers. Teachers expected students to synthesize information from multiple sources and add their own thinking to teach audience members about their topic. . The media specialist believed, “It doesn't do any of us any good if I just spit out the information and tell you to memorize it.” Before presentations, students had opportunities to practice and receive feedback from peers and teachers. This feedback helped students reflect upon their presentation and improve upon the quality before the actual presentation.

During presentations, students in the audience asked probing questions of the presenters. Sometimes these questions caused students to reflect upon the content or process that they had not thought about throughout the project. One student asked, “How many ferries came to Ellis Island every day?” The group presenting was unable to answer the question but responded that they would find out for the student asking the question. During a kindergarten presentation, one student explained how he forgot a side door in his hospital design. The student explained how he would improve the design if he had to do the project over. In kindergarten, one audience member asked, “How did you make that tree?” The student’s curiosity came out of a desire to add a similar tree to his own project. The presenter shared his thinking and the process for creating the tree. This type of authentic reflection helped students experience reflective questioning from their peers in addition to the teacher. It also helped them learn from others and extend their thinking.

Reflection was an important component at the end of a project so students could reflect upon the entire PBL cycle. Teachers regularly met with students after a project and talked about how the project went and how the group worked together. In kindergarten, teachers asked students to think about their partners' strengths and weaknesses in hopes of seeing improvement on the next project. Teachers used rubrics to help students reflect upon their knowledge of the standards and the group dynamics of the project.

Teachers and students benefited from reflecting about the process.

Effective PBL implementation happened when teachers and students reflected about the PBL process. Despite significant staff training, teachers believed PBL required continual reflection and modification for teachers and students. Students and teachers benefited from thinking about the PBL process during and after projects.

After a few years of PBL implementation and reflecting upon student work, staff members felt students needed direct reminders about pathways. Staff members discussed the importance of branding to ensure all students understood student pathways and how to apply their training into final products. Students received most of the pathway training through the inquiry specials. Students were encouraged to use the knowledge they received from the pathway training into their projects. The inquiry team created visuals for each pathway and encouraged teachers to post them during projects so students understood components of each pathway as they moved from one grade to the next. Video production looked different in second grade than it did third grade. Staff members wanted students to understand that a variety of tools fell under the video production pathway. Branding created an awareness and added level of depth to the pathways.

Additionally, teachers reflected upon their use of student planning documents and graphic organizers. Consistency became important with these documents and improved the quality of student work over time. In 4th grade, students used the same graphic organizer for every project during the research phase. Teachers used the same First Five/Last Five planning documents and believed modeling how to use them was important. Finally, through years of PBL experimentation, teachers believed the first 20 days of school was important to set a classroom culture of PBL. During this time, teachers planned lessons aimed at teaching the PBL process. The familiarity with the process and planning documents enabled students to focus more on the content work efficiently.

Teachers and students benefited from reflecting upon the process. One of the biggest challenges for students during a project is making sure the entire project aligned with the driving question. Teachers held students accountable by asking them to explain how the work aligned to the driving question. In kindergarten, reflection happened through oral conversations with the teacher as a whole class, small groups, and individually. Kindergarten students required teacher direction throughout the entire project to reflect upon their learning. Students studied one community helper each day, created class anchor charts, and drew pictures of the helpers they studied. Ongoing anchor charts helped the teacher record student thinking and track how it evolved throughout the project. Oral reflection was common in the upper grades, however written reflection also occurred. On student artifacts, teachers provided written feedback to students on project plans or documents through google docs. Teachers asked reflective questions that helped students stay focused on the driving question and important research.

For students, reflection happened continually throughout the project. Groups created roles and responsibilities on project work plans. In one group, roles included cinematographer,

director, anchor, green screen, host, and actors. During the First Five/Last Five, students reflected upon their roles each day and discussed how their group could be more effective. This time was important to ensure students reflected upon problems and challenges with their plan or individual group members. The art specialist noticed giving students an opportunity to reflect during and after the project allowed them to "become aware of their strengths."

One of the challenges for students during projects was skipping ahead to the final product too quickly. Participants spoke of tools that encouraged reflection in projects. Teachers in second grade used checklists to ensure students completed all components of the PBL process. Students completed checkpoints to move on to the next portion of the project. It required students to reflect upon the completed work and think about what to do before moving to the next phase of the project. The art specialist believed "checklists really helped because they had to look at where they were before they could move forward."

Teachers required students to fill out rating scales to help reflect after a project. Students completed rating scales on each group member at the end of the project to evaluate each group members' contribution to the group, collaboration, and overall effectiveness. Students shared their perceptions of group members' strengths and weaknesses and discussed them in a small group setting with the teacher. In addition to group ratings, the principal stated students completed a self-evaluation where they reflected upon "things that went well and things that didn't go well." Peer and self-evaluations helped students reflect upon their overall group and individual success. Students saved evaluations and reflected upon the feedback they received throughout the year. This type of reflection helped students think about the challenges encountered in each project and improve moving forward. Reflection played an important role for students and teachers during PBL.

Academic achievement.

The literature review outlines work from previous research to define student achievement for this study. The findings indicated that while standardized assessments are one measure to assess student learning, they do not tell the full story of these students' learning. PBL seems affords students opportunities to learn beyond the standard. Additionally, PBL has an impact on academic achievement for a variety of subgroups. For purposes of this study, academic achievement includes academic content (literacy, science/social studies, and math) and academic skills (problem solving and critical thinking).

While, participants believed PBL affected student achievement for a variety of students, achievement data does not exist to support their claims. Unfortunately, no longitudinal data was available from initial PBL implementation at the school and changes in state assessment over the last few years make it difficult to compare student achievement over several years. Thus due to the qualitative nature of this study, this section focuses only on the perceptions of participants.

Standardized assessments may not tell the full story.

Participants overwhelmingly believed standardized assessments did not fully capture the knowledge students gained through PBL. The school district ranked each school using an internal rating system. A significant portion of the ranking system included assessment results from the state's standardized assessment (third thru fifth grade only) and Iowa Test of Basic Skills (second and fifth grade only). The ranking system measured the overall student performance as well as the school's performance in context. Participants stated the school performed in the top 10% of the county on the raw data from the state assessment; however, when it came to growth and the school's performance in context (compared to schools with similar demographics) the school's performance suffered. This portion of the ranking system

compared the schools' performance to other schools with similar populations. The principal stated, "growth wasn't where the county wanted it to be based on population." Participants believed student learning did not match where the school fell on the internal ranking system. The assistant principal stated, "When I look at the data and I look at some of the schools right now that are doing well, they adhere to a much more traditional approach and they don't necessarily embrace the approach that we have." It is important to note, the school ranked higher on the ranking system in previous years with a different formula and received a financial incentive the previous year for being one of the top elementary schools in the district. The administrators believed the population of the school was different from other schools with a similar free and reduced lunch rates. The principal stated:

> When you really dig deep, it's not totally the same population, because we only have 18% free and reduced lunch, but the other percentage of our kids are not wealthy with lots of experiences and exposures. We're a good middle class, well rounded community. Our kids are involved in sports and activities. The parents, they go to Disney World for their vacation. They don't go to a museum, and not all of them, so they're well rounded.

The principal went on to say that they were "missing the mark" by two to four students in every classroom and needed to focus on differentiating and honing in on those students for growth. The administration believed if students continued this learning through middle and high school they would eventually be "at the top of the heap." Participants believed that the ability of students to articulate their learning to adults was very high level and provided a more accurate picture of student learning. The media specialist stated, "I know something's going right here. Our kids are strong. They test well. They know a lot, but compared to other schools with our same demographics we should be stronger."

Administrators asked district personnel if instructional changes needed to occur based on the school's recent internal ranking. District personnel told the administrators to continue with their current trajectory based on the "level of what students are producing." Administrators plan to focus on small group instruction and continually assess students' mastery of the standards. They believed differentiation, remediation, and enrichment optimize student learning. The principal stated, "It's knowing the kids and then giving them what they need [in small groups]. That's where your real teaching and learning takes place and that's a little bit of a shift, and we've just gotta help our teachers now. That's really hard work."

Participants believed that information students learned did not always show up on a standardized assessment. Through branching questions, student learning encompassed topics that do not appear on standardized assessments. A few years ago, one group conducted research on a gene that related to breast cancer. They conducted interviews with an oncologist and a study of cancer cells. The assistant principal felt the project was "spectacular," but students may have learned information that was not on the standardized test at the end of the year. The assistant principal said it was hard to know if the project helped the students on the state assessment, but believed it helped them "learn process skills that, to me, will make them better citizens, better humans, and better employees in the future."

PBL affects student achievement for a variety of subgroups.

Participants noted that PBL was effective for multiple subgroups as teachers could differentiate projects. The kindergarten teacher believed PBL allowed teachers to "foster different learning styles" through the formation of groups, research phase, final product, and student presentations. In addition to learning styles, PBL gave students opportunities to work in their strengths. The principal stated,

> For some of our children who need extra support in learning reading, writing, and math. They have gifts and talents that are able to really shine in a project. Maybe that they have great organizational skills or they're very artistic or they can think, they can problem-solve in creating something. They may be very creative, so it's allowed some of our children who struggle with the academics of school an opportunity to share their gifts and talents.

Teachers had opportunities to differentiate presentation modes by allowing students to use visual representations, written descriptions, and models to explain their research. Some students used notecards during presentations and others had it memorized. Another way teachers differentiated projects was through grouping strategies. Teachers believed students learn from one another and create strategic groups to maximize peer learning.

Participants differed in who they felt PBL affected the most. The media specialist believed PBL affected "above average" students who may not qualify for the gifted program, but benefited from opportunities to extend their learning. The media specialist believed those students "do a stellar job on projects as well as the child who's gifted." In addition, the media specialist felt PBL benefited gifted students because they could "go above and beyond" the standard if they chose. The kindergarten teacher believed high achieving kindergarten students benefited from PBL because teachers could "push them further" than they could in a traditional setting. Participants believed PBL benefited high achieving students because of the ability to extend their learning.

In contrast, several participants noted the benefits of PBL for struggling students. One of the benefits of PBL was how research was structured. Students who struggled in reading had opportunities to access information through other means such as videos, videoconferences, and

conversations with group members. The kindergarten teacher noted that struggling readers had difficulty staying engaged due to their frustration levels with the text complexity. PBL enabled these students to acquire information through other means and allowed the teacher to "remove roadblocks."

The assistant principal noted the school saw increased academic achievement with special education students since PBL implementation "if it's structured correctly." During one of the observations, the special education and general education teacher co-taught the class. One student, who had difficulty speaking in front of large groups, recorded his presentation on an IPAD and showed it during student presentations. The student smiled throughout the video and appeared to be proud of the work. The fourth grade teacher stated special education students had difficulty reading during the research phase and needed support, but during the presentation they "did really well because they had the information in their head." The fourth grade teacher felt PBL was most successful for special education students when there was a high level of collaboration between the co-teachers. Special education students needed additional support throughout the project, but articulated the content and demonstrated excitement on presentation day. Teachers used accommodations to help struggling students demonstrate success.

Participants believed PBL benefited a variety of students because it gave teachers an opportunity to differentiate processes and products. When structured appropriately students benefited from differentiation in PBL.

Students learn beyond the standard with PBL.

Participants believed PBL gave students opportunities to extend their learning beyond the standards. Student branching questions aligned to the standards, but their structure allowed students to research information that was not in their science and social studies textbooks. The

fourth grade teacher stated, “It got them thinking a little more deeply than describing an ecosystem in a world or something like that. It got them thinking how changes in an ecosystem really happen.” Teachers required students to answer how and why questions throughout projects, which helped students think beyond the textbook.

During presentations, students had opportunities to share their own thinking about the topic with the rest of the class. Students had opportunities to synthesize their thinking and explain how they felt about the topic. During one presentation, students discussed unequal payment between Chinese and white workers for the exact same work on the transcontinental railroad. One student stated she felt it was unfair for white workers to receive more money than Chinese workers. Most students appeared to have a deep understanding of their topic and used academic vocabulary to explain their thinking. Teachers required students use academic vocabulary to explain their topic during student presentations.

During presentations, projects appeared to help students understand the bigger picture. In one project, students talked about an oil spill and its effect on animals’ fur. They articulated how the oil spill itself did not directly cause a change in the ecosystem, but the animals losing their fur created a big problem that disrupted the balance. Students in fifth grade demonstrated an ability to summarize and synthesize information, as they did not read directly from the infographics they created. During student presentations, audience members asked how and why questions. Presenters consistently provided appropriate explanations to the questions. One audience member asked, “Why do rhinos who aren’t in the wild have metal plates on them?” The presenters provided an explanation they found in their research about the purpose of the plates. In another fourth grade presentation, students asked questions related to damage caused by deer. Group members talked about the damage deer cause and its effect on the economy. The standard

did not directly address the economy, but students could articulate the information because it related to deer affecting an ecosystem.

Teachers emphasized the research phase over the final product. The media specialist stated, “I think a lot of people think that a pretty product means that it’s a successful project.” The media specialist believes a successful project includes:

> All of the parts from beginning to end, from front loading through that active engagement, I think that the research piece, the creation piece, I think a successful project really digs into each of those pieces. If it happens to be pretty and flashy at the end, that's just a bonus.

The art specialist explained that some teachers used to concern themselves with the final product. After gaining PBL experience, she no longer defines success on “the end product.” The fourth grade teacher believed a successful project happened when “Students can talk about a project without any aids.”

While PBL offered students opportunities to go beyond the standard, one of the risks was students getting too far off the standard. The school believed in student voice and choice, but had to find a balance between staying aligned with the standards and giving students’ voice and choice in the project. In second grade, student projects focused on text features. During student presentations, students had difficulty articulating the text features in the books they created without teacher support. Students articulated the content of the book with ease; however, the purpose of the project was to apply their knowledge of nonfiction text features into a student created book. During the interview, the teacher reflected about this challenge and stressed the importance of conferring more frequently to catch mistakes like this. Teachers stated frequent formative assessments and conferring helped ensure student projects aligned with the standards.

Based on conversations with participants, the researcher perceived PBL to be most effective when students had a copy of the standards and the teacher continually revisited the standard throughout the project using formative assessments and systematic conferring.

In addition to academic content, students benefited from PBL due to the opportunity to develop soft skills. Staff members spent significant amounts of time focused on soft skills such as collaboration, critical thinking, problem solving, and communication. In kindergarten and 2nd grade, teachers felt PBL forced students to be creative in their approach to creating final products and solving problems. In 5th grade, part of the presentation rubric that the teacher used addressed students' speaking ability and body language. Teachers targeted a few soft skills each project to work on with students. The media specialist stated she was "proud" of the students during presentations because of their progress in making eye contact during presentations. The assistant principal believed PBL gave students opportunities to practice soft skills needed to be successful in future careers. She stated:

> I see first, second, kindergarten, third grade kids that could probably go into a company and floor the employers with their strong skills. So I know how I sleep at night is because I know that the kids that we have here are gonna be leaders in their chosen professions.

Participants believed PBL prepared students through content knowledge, but also prepared them to make a difference in the world. The principal spoke of projects from previous years that affected those in the community. One group conducted a project that spanned over several years collecting canned goods for a food drive. Another group created a short film based on an interview they conducted with a WWII veteran that was placed in a museum. The assistant principal stated PBL makes students "better citizens and employees" and forces them to "come together as a team."

Limitations.

This exploratory case study provides insight into the effectiveness of PBL in elementary classrooms. It is important to note that the study is limited to one school, at one point in time. All interviews, data collection, and interview transcriptions took place between August 2017 and November 2017. Importantly, this study took place early in the school year. As the school year progresses, students become more familiar with the PBL process and projects will likely become more sophisticated. The present study provides only a small sample of PBL's effect and further studies could provide additional information on the effectiveness of PBL in K-12 education.

It is assumed the participants answered truthfully and accurately based on their experiences with PBL. Participants were informed that their answers would be anonymous in an effort to collect unbiased data.

The study is bound by time and place and limited to administrator and teacher perceptions. Lincoln and Guba (1985) contend in naturalistic research that it is important to bind a study to allow the participants to define the focus versus the researcher's preconceived notions. Another limitation of the study is the researcher did not interview students due to the time constraints. This particular study will not take into account other factors such as parental engagement or student involvement in after-school activities that may also play a role in student development and the enhancement of 21st century skills.

Another delimitation of the study includes being restricted to one school's model of PBL implementation. Since there is no singular definition of PBL, implementation may look different at other schools and could provide dissimilar results. The case is limited to observations of four teachers as a limited number of teachers were able to attend the Buck Institute training. Due to time constraints, the researcher conducted one observation in each of the participants'

classrooms to observe the final student products during presentations. Observation provided information about PBL implementation in the classrooms of the teachers taking part in the study. The exploratory case study provides further perspectives on the impact of PBL on student outcomes.

Discussion.

The purpose of this case study was to explore teacher and administrator perceptions of PBL's effectiveness on elementary student outcomes. The research used constructivism to gain a better understanding of the perception of veteran educators with extensive PBL training and experience. The case study included eight teacher and two administrator interviews, four one-hour classroom observations, and student artifacts. Participants included four teachers and two administrators with extensive PBL training and experience. The data were coded, analyzed, and organized by research questions and further categorized by sub codes. The study was based on three research questions:

1 What is the perception of teachers and administrators with regards to PBL's effectiveness on student engagement?

2 How do teachers and administrators describe the impact of PBL on student inquiry and reflection?

3 What is the perception of teachers and administrators on PBL's impact on student academic achievement?

The researcher created four categories related to the studies' research questions and findings. The findings were grouped and outlined by research question in the findings section. The researcher merged similar findings and compared relevant research from the literature. The researcher highlighted the findings of the study into categories. The purpose of this section is to

provide further insight into those findings through a detailed synthesis of the research and previous literature. The discussion includes literature on PBL from previous research meant to provide further understanding into PBL's effect on student outcomes.

This section highlights emergent themes and patterns from the findings. The researcher developed four takeaway categories by merging related findings statements and removing findings statements that did not add to the larger themes (see *Figure 2.4*):

1. PBL increases student engagement
2. Structure and support matter during the inquiry process
3. Reflection enhances quality
4. A gap exists between student learning and performance on standardized assessments

Category 1 describes the impact of PBL on student engagement. Category 2 relates to participants' perceived structures and supports needed for successful PBL implementation. Category 3 relates to the effect of reflection on the quality of PBL projects. Category 4 describes participants' perceived disconnect between students' content knowledge and their performance on standardized assessments.

Category 1: PBL increases student engagement.

The first research question sought to explore the perception of PBL's effect on student engagement. Participants overwhelmingly believed PBL increased student engagement through its ability to motivate and energize students, it provided relevant projects by giving students a voice, and helped teachers keep students focused and on-task.

Topic	Category	Findings Statements Included	Findings Statements Removed
Engagement	PBL increases student engagement	PBL motivates students Student involvement in the decision making process increases engagement PBL changes student engagement Presentations increase student engagement	PBL impacts engagement for a variety of subgroups
Inquiry	Structure and support matter during the inquiry process	The structure of PBL plays a significant role in the extent of student inquiry. There is a perceived correlation between the quality of inquiry and the amount of teacher support	Students learn from each other Teachers need support from others during the inquiry process
Reflection	Reflection enhances quality	Reflecting upon the final product improves the quality. Students think deeper when they reflect about the learning.	Teachers and students benefit from reflecting about the process. Students benefit from teacher involvement in reflection.
Academic Achievement	A gap exists between learning and performance on standardized assessments	Standardized assessments don't tell the full story PBL helps students learn beyond the standard	PBL impacts student achievement for a variety of subgroups PBL develops students' soft skills

Figure 2.4. Categories

Teachers in kindergarten through fifth grade believed students were more motivated during a PBL cycle than traditional instruction. The principal felt since initial PBL implementation, the biggest change has been in student engagement (specifically motivation). Research on previous PBL studies confirms this notion. Tamim and Grant (2013) found PBL to be more motivating and engaging with students in fourth through twelfth grade. Additionally, Halvorsen, Brugar, Block, and Berka (2012) reported second grade students had "higher motivation" as a result of PBL. (p. 5). Through a survey, Kaldi, Filippatou, and Govaris (2011)

found elementary students who participated in a PBL showed higher levels of engagement than students who did not.

Milner et al. (2011) wrote that PBL motivates students because it allows them to see the relevance of their learning to their own lives. Students appeared most engaged when there was an obvious personal link. One group discussed the impact of deer overpopulation. The students selected the topic because they were deer hunters. Students in this project were eager to share the information they learned because the learning was relevant to them. Larmer et al., (2015) wrote about the importance of student voice and its impact on intrinsic motivation during a project. PBL may be most effective when students have choice in the topic, research, and final product.

Participants believed PBL increased students' intrinsic motivation. Participants stated student attitudes improved during projects. Students were excited to come to school and frequently worked on projects outside of school without the teacher assigning additional work. Froiland et al. (2012) noted benefits of intrinsically motivated students including improved behavior and greater happiness. Parents at the school frequently thanked teachers and administrators for letting their children do projects because of their child's excitement about learning. Saez-Lopez et al. (2016) found PBL makes learning fun and creates enthusiasm in students. Student enthusiasm was evident in presentations and demonstrations as students excitedly shared their learning with others. Chang, Lou, and Chen (2013) reported students had positive attitudes that had a positive impact on student learning and allowed them to attain "greater scientific knowledge." Milner, Templin, and Czerniak (2011) found a positive correlation between student attitudes and student achievement.

Previous research indicates a connection between motivation and student achievement (Chumbley et al., 2015; Tseng et al., 2013). Chumbley, Haynes, and Stofer (2015) wrote about

the impact of motivation being a predictor for academic success. In this study, motivated students did not always achieve at high levels on standardized or classroom assessments; however, participants stayed motivated, and participants felt that academically struggling students could articulate their learning more effectively after a PBL cycle. While there was not a direct correlation between student motivation and student achievement on standardized assessments, there was a correlation between engagement and students' ability to articulate their learning. Students who struggled on standardized assessments had other deficits that prevented them from adequately portraying their learning such as reading deficits, attentional challenges, or testing anxiety.

Participants commented on student engagement more than anything else when asked what they have noticed since initial PBL implementation. Hernandez-Ramos and De La Paz (2009) noted students with higher engagement also had higher levels of content knowledge. Previous research and the findings of this study indicate PBL positively increases student engagement.

Category 2: Structure and support matter during the inquiry process.

The second research question sought to explore the perception of PBL's effect on inquiry and reflection. According to the fourth grade teacher, students at the school "question everything." Participants talked frequently about the schools inquiring approach to learning. Participants pointed out that creating a culture of inquiry required a change in mindset and significant training. Through years of explicit modeling, think-alouds, and extensive mini-lessons staff members created a culture of inquiry that trickled down to students. In the beginning, teachers wrestled with the PBL approach as it proved to be more open ended and allowed for wider variance in student products. Roessingh and Chambers (2011) wrote that a

shift in mindset was required to move from lecture-based instruction to inquiry-based instruction. Participants talked about the culture of inquiry the school created. Significant intentionality, support, and training helped create this culture. Effective PBL implementation may require a shift in mindset and practices.

Larmer et al. (2015) believe students have questions that lead to more questions during the inquiry process. This proved to be true during student presentations. Audience members asked questions that required additional research. Group members often responded with comments such as "I'll have to get back with you on that because we haven't researched that yet." Students created branching questions based on driving questions. In addition, student research led to additional questions. Students embraced the questioning approach. The kindergarten teacher believed students were "naturally inquisitive" but warned that a teacher could squash their questions. Teachers at the school were encouraged to question along with students. This created a community of inquirers that encouraged students to ask questions. Sever and Guven (2014) found that "resistance behaviors" reduced when students had opportunities to inquire about their learning (p. 1603). Over time, students at the school became better at asking questions and thinking deeply. There appeared to be very few resistance behaviors among students as they enjoyed inquiry because of the culture that existed at the school.

In addition to asking questions, inquiry included designing experiments and conducting investigations. Capps and Crawford (2013) found students benefited from taking part in the entire inquiry process. Participants in this study believed including students in the entire process was important for student learning, even if it meant students failing on a project from time to time. One group had difficulty deciding upon their final product. The teacher was tempted to make suggestions, but decided to see how the project would unfold. The students struggled, but

realized during the reflection at the end of the project what changes they should make to their next project to improve it. The temptation to allow students to struggle with the process may benefit them in the long term as it allows them to take ownership over the problems and find solutions.

English and Kitsantas (2013) found including students in the entire inquiry process engaged students. At this school, students wrote branching questions, created work plans, collected research, and designed and redesigned their final products. Teachers found that as students got older they became more comfortable with this process and needed less support in the upper grades than lower grades. Students who moved in from other schools or had little PBL experience struggled designing and conducting investigations. Capps and Crawford (2013) believe it takes time for "students to understand how scientists do their work" (p. 499). Students benefited from continual PBL exposure and improved the quality of their work as they gained knowledge and experience with effective processes and procedures.

Participants felt teachers and students needed proper training to inquire throughout the entire project successfully. At this school, an inquiring outlook began with the administration and trickled down through the teachers to the students. This may be an important component of successful PBL implementation.

Category 3: Reflection enhances quality.

In addition to inquiry, the second research question sought to explore the perception of PBL's effect on reflection. Reflecting throughout a project helped students form understandings, improve final products, and become comfortable with the PBL process.

Participants unanimously agreed that when students thought about their work the quality improved. Previous research on PBL shows benefits of reflecting upon a project; however,

researchers emphasize reflection at different points in a project. English and Kitsantas (2013) found students need "frequent" opportunities to reflect and make changes to projects (p. 136). Other researchers found reflection more valuable at the end of the project (Lattimer & Riordan, 2011). At this school, students continually reflect throughout all phases of a project. Over the years, teachers found students who did not spend time reflecting upon branching questions and research missed the mark on the presentation and final product. Participants felt students do not always reflect naturally and may need built in time to encourage student reflection.

Teachers at the school spoke about a number of strategies they used to encourage reflection. Teachers spent great amounts of time conferring with groups on projects. Conferring happened daily at all points in a project. Teachers stressed the importance of knowing each student individually and the amount of support required to help the student experience success. Conferring notes help teachers monitor how students' progress throughout a project and help the teacher get to know students' strengths and weaknesses.

Some students were unaware of their misconceptions and needed explicit re-teaching to clarify clouded thinking. Students who struggled reflecting needed the teacher to model their own thinking aloud. Daily conferring allowed teachers to identify student misconceptions and re-teach as needed. Additionally, students benefited from reflecting upon first and second drafts of presentations and final products. Berger (n.d.) found students benefit from creating more than one draft during projects because it allows them to refine their product after careful reflection. During conferences about rough drafts, teachers asked students to provide a copy of the branching questions. Teachers checked for alignment to the branching questions, research, and final product. If teachers found projects were misaligned, they asked reflective questions to help

students make necessary revisions. Daily conferring may be a necessary support to encourage students with reflection.

Additional reflection tools used by participants include checklists, rubrics, and individual/group rating scales. Jerzembek and Murphy (2013) wrote about the importance of using age-appropriate reflection tools. Others wrote about students benefiting from tools that aided in reflection (Bell, 2010; Lattimer & Riordan, 2011; Shome & Natarajan, 2013). In second grade, teachers used a checklist during conferring to help students monitor their progress on the project. Second grade teachers required students to complete checkpoints on the checklist before moving on to other parts of the project. Checklists may be necessary to help students finish one component of a project at a time.

Teachers used rubrics and rating scales to encourage reflection during projects. Teachers gave students copies of rubrics and teacher comments. Students had opportunities to reflect upon the rubric with their group members. Some teachers required students to save the rubrics in their PBL binder so they could reflect upon previous projects later in the year. Some participants found building in time for reflection at the end of the project was challenging due to time constraints, but felt this reflection was valuable. Lee and Lim (2012) wrote that self and peer evaluation helps students monitor the processes and products of group learning. Teachers in 4th and 5th grade used rating scales to help students reflect upon their own work and their groups' work at the end of a project.

Bell (2010) found students benefit from self and peer-evaluations because it helps them reflect on their personal learning and collaboration among the group. At this school, teachers designed rubrics to help students reflect upon their collaboration skills, quality of the presentation/final product, and contribution to the group. Teachers found the rating scales helped

build awareness and improved students' ability to work together on future projects. The ratings scales helped students become aware of their strengths and weaknesses. Shome and Natarajan (2013) found self and peer assessments help students to analyze work and set rigorous goals. Providing opportunities for groups to reflect through presentation rubrics and rating scales may be necessary tools to aid in reflection.

Students gave feedback to their peers through rating scales and dialogue. This feedback helped students reflect upon their work and the perception of their group members. Some researchers found tools such as rating scales aid students in reflection (Bell, 2014; Jerzembek & Murphy, 2013; Larmer et al., 2015; Lattimer & Riordan, 2011). It appeared reflective tools encouraged reflection as well as dialogue during student presentations. English and Kitsantas (2013) found reflection occurred when students went public with their work. Audience members gave frequent feedback to presenters and asked questions to clarify thinking. Participants believed this feedback was valuable as students in each class had opportunities to ask questions and make comments to the presenters after presentations. Students benefited from teacher created reflection tools and continual dialogue about projects. Some students needed support and modeling to reflect upon their project adequately.

Category 4: A gap may exist between student learning and performance on standardized assessments.

The third research question sought to explore the perception of PBL's effect on academic achievement. Research collected in this study adds to the literature about PBL's effect on academic achievement. Many researchers found PBL increases student achievement (Boaler, 1999; Catapano & Gray, 2015; Han et al., 2016; Ilter, 2014; Smith & Pastor, 2016; Strobel & Van Barneveld, 2009; Thomas, 2000).

Participants in this study overwhelmingly agreed that PBL had a positive impact on student achievement when compared with traditional instruction. Research from previous studies aligns with this idea (Lattimer & Riordan, 2011; Thomas, 2000). Due to the changes in state standardized assessments and the county's internal ranking system over the last several years; it was difficult to compare student achievement before and after PBL implementation. Most of the participants believed since PBL's inception student achievement increased, but due to the lack of a consistent assessment, there is no tool to measure its impact. Because of this, the researcher selected a qualitative approach that gives the perceptions of participants instead of quantitative data. Other researchers such as Lattimer & Riordan (2011) found increased achievement through written reflections and comments from stakeholders. Participants in this study held similar beliefs to those in Lattimer and Riordan's. The perception of participants aligned with previous research that PBL is an effective strategy for increasing academic achievement.

Researchers such as Strobel and Van Barneveld (2009) found PBL instruction might favor long-term knowledge acquisition whereas traditional approaches favor short-term knowledge acquisition. This school did not achieve the results they hoped for on the county's internal ranking system. The assistant principal believed schools that scored higher with similar populations were more traditional in their approach to teaching and learning. If Strobel and Van Barneveld (2009) were correct in their findings, this may explain the school's challenges with the county's ranking system. Based on classroom observations and presentations in this study, students appeared to have a deep understanding of the content and were able to retain and articulate this knowledge in the short term.

This study did not account for students' ability to retain information over a long period of time. In this study, the researcher did not administer a pre or posttest to test Strobel and Van

Barneveld's (2009) findings. The fourth grade teacher believed most students acquired short-term content knowledge because they could "talk about the project without aids." Teachers in each grade level felt most students could articulate their learning. Additional research would provide more information about PBL's effect on student achievement in traditional versus PBL schools in the short and long term.

While the majority of participants perceived that students benefited from PBL, the school's ranking may contradict this belief. Students in third through fifth grade scored high on student achievement when looking at the raw data; however, when compared with schools of a similar demographic, the school underperformed. One possible cause is that standardized assessments in this state required significant reading. Students who read below grade level may have difficulty performing well on standardized assessments, even if they could articulate the content knowledge orally. Additionally, the assessment was comprised of multiple choice and written response questions. Students that are below grade level in writing may possess the content knowledge but lack the ability to articulate their knowledge in writing. Teachers may need to spend extra time in small groups with struggling readers and writers to help them comprehend test questions/passages and articulate their knowledge through writing. The overall perception of participants in this study was that PBL was an effective approach to increase academic achievement. Further research is required to determine PBL's overall effectiveness.

Implications.

The findings indicate PBL is complex pedagogical method and requires training and dedicated staff members. This study includes theoretical, leadership practice, and policy implications.

Theoretical Implications.

Instructional leadership theory offers ideas on how school leaders can implement instructional programs such as PBL and outline its effect on student outcomes when implemented with fidelity (Burke, 2014; Hallinger, 2003; Rigby, 2016; Salo et al., 2015). Originally, instructional leadership theory focused on a top-down approach with the principal being at the center (Burke, 2014). As Macneill, Cavanagh, and Silcox, (2003) stated, traditional views of instructional leadership focused on the principal as the leader where more contemporary views show "multiple layers" to leadership (p.15). Initially, the school's principal set the vision for the school-wide focus on inquiry and project-based learning. While this vision initially came from the top, it required shared leadership to implement the vision successfully. The principal created a leadership team that attended the Buck Institute training and shared the leadership among team members. PBL success at the school would not have been possible without leaders in each grade level providing training and support to grade-level team members. The leadership at the school valued the input of teacher leaders and engaged in constant conversations that affected the school's vision and professional development. While the instructional leadership theory begins at the top, successful implementation requires leadership from others.

The principal set the tone for the vision in the beginning, but needed to be open-minded as the school's vision evolved over time. Rigby (2016) suggested that principals are responsible for the operations at the school as well as the academic success of the students. In this school successful PBL implementation required responsibility from teachers, administrators, and students, not just the principal. The principal and assistant principal created a professional learning structure to ensure academic success, but needed the team around them to help advance the vision. Over the course of several years, the school's vision evolved because of input from

stakeholders. The school began as a workshop school, moved to an inquiry focus, and eventually landed on PBL. This shift came from the needs leadership observed in students and teachers. Initially, the students needed growth in literacy, but the focus shifted as students became more proficient in reading and standards became more inquiry-based. Eventually, students became better at researching and asking questions and there was a need for students to have a platform to articulate their learning. The school shifted to project-based learning because it provided opportunities for students to apply the content knowledge gained through inquiry to real-world applications. The leaders shifted their vision to align with the needs of the students. This implication is important for the instructional leadership theory as the principal must take input from others and open to modifying the school's vision to meet the needs of the students.

Principals should engage in professional development to advance the vision of the school (Salo et al., 2015). Salo et al. (2015) pointed out, in order to improve teacher practice; principals must engage in conversations with teachers and plan effective professional development. This proved to be important through the amount of release time the principal offered teachers; however, in this case, the principal recognized that teacher leaders played a role in advancement and chose to include them in the release planning days. The principal paid to get subs for the art, media, and technology specialists to attend each grades' release planning days because she recognized the value they would bring to the collaborative planning sessions and provide another perspective that would prove valuable to classroom teachers. The principal had the entire administrative and inquiry team attend grade-level release planning days to provide a variety of perspectives. In this study, the principal believed teacher leadership played a role in improving teachers' comfortability and effective implementation of PBL.

Leadership Practice Implications.

Before embarking upon a PBL initiative, school leaders must understand the training for staff members necessary to make PBL successful. Teaching through PBL requires a shift in thinking from more traditional approaches. School personnel at this school found success with PBL in large part because of the training and support they received from local experts, district personnel, and outside trainers from the Buck Institute. The leaders at this school invested a significant amount of time and resources to ensure success. When teachers struggled initially, school leaders demonstrated creativity with staffing by forming an inquiry team comprised of three teachers to support classroom PBL. This team helped teachers become comfortable with PBL and provided additional resources for successful classroom implementation. This flexibility, demonstrated by the school's leadership team, played a role in the successful implementation at the school.

The schools' leaders created a culture of inquiry and exploration that transcended into the teachers and students. This type of leadership aligns with more recent views of the instructional leadership theory. As Macneill, Cavanagh, and Silcox, (2003) stated, traditional views of instructional leadership focused on the principal as the leader where more contemporary views show "multiple layers" to leadership (p.15). In creating this culture through multiple layers of leadership, school leaders showed they valued student opinions, which led to an increase in student engagement during projects. Throughout interviews, the principal discussed the importance of "listening to the students."

Part of the culture of inquiry at the school was being open to new ideas and not being afraid of failure. The school leaders embraced failure in teachers and students as they saw the value in learning from one's mistakes. Teachers seemed unafraid of blame from administration

if a project did not turn out as expected. The level of trust given by the administrators enabled the teachers to embrace innovation and creativity and not shy away from trying new things.

In addition to showing the role administrators play, the findings of this study can inform teachers' work. Teacher leaders played a significant role in creating a PBL culture in students and staff members. Teacher collaboration played a significant role in creating this culture. As teachers collaborated, they recognized the value of the student voice. Students had ownership over all parts of a project cycle. The ability for students to have voice and choice during projects led to a high level of student engagement during projects, however, this level of choice required flexibility on the part of the teacher as each group project was unique. As students became more familiar with the PBL process (throughout the year and across grade levels) their work improved. This improvement would not have happened without teacher leaders valuing students' voices.

Policy Implications.

Policy makers should take note of this study as employers desire workers with well-developed 21st century skills and PBL may provide opportunities for students to develop those skills. While some employers' desire 21st century skill sets as much as content knowledge, standardized assessments often do not measure 21st century skills (Boss, 2012; Larmer et al., 2015). Participants in this study believed standardized assessments did not accurately portray students' content knowledge or their 21st century skills. If policy makers desire PBL as an instructional approach, they would benefit by finding alternative ways to measure student learning other than traditional standardized assessments. Boss (2012) wrote about drawbacks of traditional multiple-choice assessments created during No Child Left Behind, as they do not depict student learning accurately. Students may be able to show their learning more effectively on performance-based assessments than multiple-choice assessments (Boss, 2012). Policy

makers should consider alternative ways to measure student learning using more open-ended and flexible assessments.

PBL requires a shift in mindset, significant training, support, and resources for interested educators. Thus, policymakers could support educators by allocating funds and resources towards continual training and support and revising standardized assessments to better align with the learning that takes place in a PBL environment. At this school, the PBL culture would not have been established without years of professional development for both administrators and teachers. Teachers needed professional development to help get started with PBL and professional development as they became more accustomed to PBL to reflect and grow. Projects were successful because leaders dedicated significant amounts of planning time to PBL. Policy makers would be wise to dedicate significant resources to professional development for teachers and administrators.

PBL requires a shift in control from the teacher to the student. This mindset is a dramatic change for many educators. Policy makers would be wise to educate stakeholders on the need for change and invest resources in changing the mindset of educators. Teachers that understand the need for PBL will be more comfortable trying to implement it. Policy makers could play a significant role in helping educators understand PBL's potential impact through open dialogue and honest discussion.

Conclusion

This study provides insight into the effectiveness of PBL on student outcomes. It opens the opportunity for future researchers to examine the long-term effects of PBL and whether it positively or negatively affects students' ability to be prepared for the 21st century workforce. While numerous PBL studies used participants with limited PBL experience (Blanchard et al.,

2010; Grant, 2011; Sunyoung et al., 2015), through purposive sampling, this dissertation includes teachers and administrators with extensive PBL training and contributes to the literature on PBL with elementary students.

The findings indicated that PBL positively affects student engagement. In addition, the findings indicted that students and teachers needed support during the inquiry process to ensure that the work designations aligned with standards. Continual reflection improved the quality of student learning in PBL. Standardized assessment may not tell the full story of PBL when it comes to student achievement. PBL may not improve student test scores using current multiple-choice and extended response assessment methods, but it does increase student engagement, improve students' ability to inquire, and helps students reflect on their learning. We need to consider PBL as a method to prepare our students for 21st century citizenship and the global economy.

Schools implementing PBL effectively see positive results with engagement and achievement; however, schools and districts considering PBL implementation should take note of the challenges of effective PBL implementation. Effective PBL implementation requires a shift in mindset from traditional approaches by administrators, teachers, students, and parents. School administrators must be careful in their initial teacher selection when launching a new PBL initiative and be willing to dedicate significant amounts of time and resources to professional development. Administrators should select key teacher leaders that are flexible, unafraid of failure, and demonstrate a willingness to replace old pedagogical practices with new. As teacher leaders become comfortable with PBL, they should take an active role in developing other teachers. Administrators need to understand that failure is an important component of the learning process and not abandon PBL quickly if the initial results are undesirable. Effective

PBL implementation takes years of practice and intentional planning but produces positive results when implemented with fidelity.

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APPENDICES

Appendix A

Questions for Administrators:

1. Describe the background of the school.
2. Describe project-based learning at your school over the last five years.
3. Describe the process for selecting teachers to attend the Buck Institute training.
    a. Describe your experience during training at the Buck Institute.
    b. Describe the role of the Buck Institute team in supporting PBL school-wide.
    c. What additional PBL training has been implemented at your school?
4. How has your school implemented PBL?
    a. Has it been successful?
5. In your opinion, how has that implementation affected student learning?
6. How does the administrative team ensure teachers are implementing project-based learning with fidelity?
7. Describe student engagement before and after PBL implementation.
8. How (in any way) has using PBL influenced student inquiry?
9. How (if anything comes to mind) has using PBL influenced student reflection?
10. Do you think PBL influenced student learning in different ways for particular subgroups? If so, explain why you hold that belief?

Appendix B

Questions for Teachers:

1. How long have you been a teacher?
    a. What educational training have you received?
    b. How long have you taught at this school?
    c. What grade level and subjects do you teach?
2. How (if at all) has PBL changed the way you approach teaching?
3. Describe your training with the Buck Institute.
    a. Describe any additional PBL training you have received over the last five years.
    b. What have you done since the Buck Institute training to refine your skills?
4. Using student artifacts, can you walk me through this recent PBL project?
    a. How did it influence student performance?
    b. Describe the engagement level of students throughout the project.
    c. What challenges did students encounter during the project?
    d. How did you encourage inquiry throughout this project?
    e. Describe the role of reflection in student learning throughout the project.
5. What does success look like in a project?
6. Describe your students' academic achievement since you started implementing PBL.
7. Describe your students' engagement since you started implementing PBL.
8. Describe your students' ability to inquire and reflect since you started implementing PBL.
9. Do you think PBL has influenced student learning in different ways for any particular subgroup? If so, explain why you hold that belief?