THE ROLE OF NEWLY PREPARED PBL TEACHERS' MOTIVATIONAL BELIEFS AND PERCEPTIONS OF SCHOOL CONDITIONS IN THEIR PROJECT BASED LEARNING IMPLEMENTATION

by

Mary C. English
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Committee:

Anastasia Kitsantas	Chair
Lynne Schrum	
Kimberly Sheridan	
Gary Galluzzo	Program Director
Mark Ginsberg	Dean, College of Education and Human Development
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By

Mary C. English
Master of Arts
George Mason University, 2000
Bachelor of Arts
George Mason University, 1988

Dissertation Director: Anastasia Kitsantas, Professor
College of Education and Human Development

Spring Semester 2013
George Mason University
Fairfax, VA

DEDICATION

I dedicate this dissertation to my parents, who exemplify the value of hard work and persistence.

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List of Abbreviations

Project based learning	PBL
Self-efficacy	SE
Outcome Expectancy	OE
Task Value	TV
Perceptions of School Conditions-School Structures	SC-SS
Perceptions of School Conditions-Teacher Participation	SC-T
New Tech Network Schools	NT
Non-New Tech Network Schools	Non-NT
Self-regulated learning	SRL

Abstract

THE ROLE OF NEWLY PREPARED PBL TEACHERS' MOTIVATIONAL BELIEFS AND PERCEPTIONS OF SCHOOL CONDITIONS IN THEIR PBL IMPLEMENTATION

Mary C. English, Ph.D.

George Mason University, 2013

Dissertation Director: Dr. Anastasia Kitsantas

The purpose of this exploratory survey study was to investigate the role of motivational beliefs and perceptions of school conditions in K-12 teachers' implementation of PBL following their completion of introductory PBL training. Specifically, this study examined how much of the variance in the extent of PBL implementation was explained by demographic variables, perceptions of school conditions, self-efficacy, outcome expectancy, and task value. Further, qualitative data were collected to determine what factors teachers reported as impacting their PBL implementation and motivation during the semester after completing the introductory training. The sample included 343 teachers from schools throughout the U.S. A portion of the sample was from New Tech Network (NT) schools, where a whole school reform approach to PBL is in place. Several surveys were administered and eighteen interviews were conducted. A comparison of NT and

non-NT teachers showed that NT teachers had significantly higher task value, perceptions of school conditions, and extent of PBL implementation than non-NT teachers. A regression analysis showed that the NT versus non-NT variable played the largest role in extent of implementation, followed by perceptions of school conditions (including a flexible curriculum, block or flexible scheduling, and adequate student technology access), level of PBL experience, and motivation. Task value was the only motivational belief found to have played a significant role in extent of implementation. Further, analyses showed that overall, perceptions of school conditions, motivational beliefs, and plans for implementation versus actual implementation decreased significantly between Time 1 (immediately following introductory training) and Time 2 (after the first two months of implementation efforts). Analysis of responses to open-ended survey data showed that time and students were the factors most frequently reported as impacting both implementation and motivation. Interview data indicated that while some teachers are more motivated to implement PBL than others, motivation improves as teachers gain experience with PBL and the level of student learning and engagement increase. A supportive school environment also contributes to teachers' PBL motivation. Based on the findings, implications for practice and recommendations for future research are included.

1. Introduction

Inquiry-based pedagogical approaches have been utilized in education since 1918 as a way to engage students in the learning process (Arends, 2009). Project based learning (PBL) is an inquiry-based model of teaching and learning that has been shown to be especially effective with unmotivated, low achieving students (Mergendoller, Maxwell & Bellisimo, 2006). More recently, project based learning has been recognized as a means of facilitating student acquisition of "21st Century skills" such as critical thinking, information literacy, collaboration, and lifelong learning (Buck Institute for Education, 2003). As such, PBL is a key feature of a number of school reform efforts in U.S. schools (Ravitz, 2010). However, because implementation of PBL—like other constructivist, learner-centered approaches—is complex and associated with largely unfamiliar methods of planning, facilitation, and assessment, it presents challenges at the personal, school, and district levels. The challenges may resemble those seen in efforts to integrate technology and other innovations into the classroom. Over time, researchers have worked to identify factors associated with successful implementation efforts, examining a number of variables associated with teachers and schools—from beliefs (Briscoe, 1991) and attitudes (Avidov-Ungar, 2010) to teaching philosophy (Briscoe, 1991; Rich, 1990) and self-efficacy (Guskey, 1988). A significant body of research points to teacher motivation as a source of teachers' willingness to commit to implementation of classroom innovations (Abrami, Poulsen, & Chambers, 2004; Fullan, 2001; Tschannen-Moran &

McMaster, 2009; Wu, Chang, & Guo, 2008). As well, many researchers have found supportive school conditions to be essential to successful implementation efforts (Bradley-Levine, Berghoff, Seybold, Sever, Blackwell, & Smiley 2010; Fullan, 2001; Hall & Hord, 2001; Hmelo-Silver, Duncan, & Chinn, 2007; Lam, Cheng, & Choy, 2010). The purpose of this exploratory survey study is to examine the role of motivational beliefs (self-efficacy, outcome expectancy, task value), and perceptions of school conditions on teachers' PBL implementation, the relationships among these variables, and how these motivational beliefs and perceptions change as teachers gain PBL experience. The specific motivational beliefs and school conditions of focus in this study were selected based on findings of prior research and due to their direct relevance to teachers' reported PBL implementation concerns.

Background of the Problem

There is a growing recognition—by business leaders and educators—of the changing demands of today's workplace, stemming from the rapid evolution of technology and the resulting flood of digital information and worldwide connectedness (Drucker, 1999; Friedman, 2005; Wagner, 2008). Some have stated that classroom practices focused on rote learning and memorization are not adequately preparing students for such demands (Partnership for 21st Century Skills, 2011; Darling-Hammond, 2008; Wagner, 2008). As such, there is a growing emphasis on the need to teach for understanding (Barron, Schwartz, Vye, Moore, Petrosino, Zech, & Bransford, 1998; Darling-Hammond, 2008; Windschitl, 2002) and to apply principles of learner-centered

instruction in the classroom (American Psychological Association, 1997; Bransford, Brown, and Cocking, 2000; McCombs & Whisler, 1997; Watson & Reigeluth, 2008).

Within the paradigm shift to learner-centered instruction, there is a growing emphasis on instruction that supports twenty-first century skills through inquiry, application, production, and problem solving (Barron & Darling-Hammond, 2008). Problem-based learning, project based science, project based instruction, design-based learning, and project based learning are examples of inquiry-based approaches. PBL is rapidly growing in popularity and becoming a key element of some school reform efforts (Ravitz, 2010).

The Buck Institute for Education (BIE), a teaching and learning center focused on the study of PBL since 1987, defines PBL as "a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic (real-life) questions and carefully designed products and tasks" (2003, p. 4). PBL's authentic projects serve as a vehicle for the learning process and provide the context for content and concept learning. In PBL, students conduct in-depth investigations, utilize technology, apply reasoning and self-management skills, create projects, synthesize information, lead presentations, and evaluate the work of others (Buck Institute for Education, 2003). This form of instruction is gaining appeal with educators who have a focus on equipping students with 21st century skills and creating learner-centered classrooms (Ravitz, 2010). However, this learner-centered, constructivist pedagogy is a major paradigm shift in teaching and learning, and thus, requires significant changes in practices at the school and classroom levels. Such changes

include student and teacher roles and expectations for student performance, assessment, and planning.

As teachers—who are central to PBL implementation efforts—attempt to make these changes, they are likely to face a steep learning curve and encounter struggles that may hinder their ability or desire to continue with implementation. Over time teachers have been the focal point of volumes of research examining the role of such teacher attributes as pedagogical beliefs (Briscoe, 1991), attitudes (Avidov-Ungar, 2010), teaching philosophy (Briscoe, 1991; Rich, 1990), concerns (Hall, Wallace, & Dossett, 1973), self-efficacy (Guskey, 1988), and others, in search of a better understanding of factors that influence teachers' decision to adopt new teaching approaches, strategies, and technologies. Attention has also been given to how schools support adoption of new teaching approaches, strategies, and technologies (Joyce & Showers, 1988; Sleeter, 1992). It is clear from the research that both personal factors and school conditions play a role in the sustainment of educational innovations. Given the complexity of PBL implementation, it is imperative that schools undertaking PBL initiatives have an understanding of how these factors relate to each other and to implementation efforts.

Theoretical Framework

PBL is an important initiative in some school reform efforts (Ravitz, 2010). As a part of the transformation to a learner-centered, constructivist approach, adoption and implementation of PBL are fraught with challenges at the district, school, and classroom levels. At the classroom level—where the learning actually takes place—teachers hold the key. Their commitment to invest the necessary time and energy required for planning,

learning, and experimenting is essential for sustained classroom change. Based on more than a decade of research, Fullan has concluded that teachers' motivation to adopt an innovation is highly personal (2001). Therefore, it is important for educators to understand what motivates teachers new to PBL to make this commitment.

The study of motivation spans a wide range of disciplines, from business and sports to sociology and education. According to Ford (1992), motivational processes are qualities of a person that are future-oriented and aimed at helping the person evaluate the need for change or action. These processes stem from the individual's personal goals, beliefs about his or her capacities, beliefs about his or her context, and emotional arousal processes (Ford, 1992).

Fullan, (2001) who has been researching educational change since 1991, and is recognized internationally for his contributions, points to several motivational factors in a teacher's decision to put their efforts into a particular change: 1) Expectations for student success, 2) perceived value and costs, and 3) sense of efficacy.

The first motivational factor for teachers is whether the innovation is expected to help their students. This question is related to the construct of outcome expectancy (Bandura, 1986). Outcome expectancy describes the consequences that one expects as a result of performing a task at the expected level of competence (Bandura, 1986). Aligned with Fullan's (2001) research findings, this theory holds that expectations influence one's decisions regarding how and where to exert efforts and focus energies. In regards to PBL, according to this theory, if a teacher expects PBL to be good for students, there is greater likelihood of motivation to adopt PBL.

The second motivational factor is perceived value and costs. This refers to the teachers' perceptions of costs and gains of time, energy, skills, excitement, and competence. This factor aligns with the construct of task value (Wigfield & Eccles, 2000). Task value is comprised of three separate components: 1) attainment value, or the importance of doing well; 2) intrinsic value, or enjoyment; 3) utility and personal costs or sacrifices (Wigfield & Eccles, 2000). Applied to PBL, this means that teachers who believe it's important to be successful with PBL, find PBL rewarding, and see the gains as greater than the personal costs, are more likely to commit to PBL implementation. Personal costs relate to the time, energy, and risk-taking associated with learning and implementing PBL.

The third motivational factor that Fullan has identified as playing a role in change in classroom practices is sense of efficacy (2001). Fullan views sense of efficacy as a result of several factors, including personality, previous experiences, level of self-actualization, and stage of career. He also highlights that the school culture or climate plays a significant role in shaping sense of efficacy (2001)—an important point when studying the role of personal factors and environmental factors in motivation. Sense of efficacy may be aligned with the construct of self-efficacy, which Bandura defines as the belief in one's capability to perform a given task at a certain level (Bandura, 1997). Bandura asserts "People's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true" (p. 2). According to the theory, higher self-efficacy in a specific context leads to more focus, determination, and commitment to a task.

Task value, outcome expectancy, and self-efficacy are motivational beliefs that Fullan (2001) has found from his research to be central criteria in a teachers' decision to invest in the change associated with adopting an innovation. Numerous studies have been conducted to examine the role of these constructs—individually and in some cases together—in teacher implementation of a variety of new teaching methods, strategies, approaches, and technology integration efforts (Abrami, et al., 2004; Tschannen-Moran & McMaster, 2009; Wu, et al., 2008).

Strong teacher motivation, however, may not be enough to sustain the implementation. According to Lepper and Hodell (1989), powerful external constraints can undermine intrinsic motivation. In other words, an environment that is not designed to support PBL may create insurmountable barriers even for the teacher who believes strongly in PBL's capability to support student success, who places high value on PBL, and who has a high level of self-efficacy. This is aligned with Fullan's belief that the school environment plays a significant role in shaping a teacher's sense of efficacy (2001). Similarly, Hall and Hord (2001) have found that change is a process (rather than an event) that is shaped by physical features of a school (such as the facilities, resources, policies, structures, and schedules) and people factors (including attitudes, beliefs, values, relationships, and norms).

Given these findings, a teacher's perceptions of such school conditions likely play a significant role in their motivational beliefs, and ultimately, their implementation and adoption of an innovation. One study that examined the relationship of school conditions and teachers' personal motivational factors in relation to PBL commitment found that the

perceived practical constraints of school conditions were more predictive of PBL commitment than the personal motivation factors (Lam, et al., 2010). Specific school conditions cited as important to PBL implementation include supportive administration, collaboration with colleagues, adequate professional development, ample planning time, block scheduling, a flexible curriculum, access to PBL experts, access to technology and resources, and adequate classroom facilities (Bradley-Levine, et al., 2010; English, 2011; Lam, et al., 2010; Ravitz, 2008).

Implementation of an educational innovation (like PBL) is a process, rather than an event (Hall & Hord, 2001). Large-scale studies have identified multiple stages that teachers go through when implementing an innovation. Hall and Loucks (1977), for example, developed a hierarchical model called Levels of Use, which measures the growth of lesson quality as teachers use innovations in their classrooms. The model identifies eight stages, from "nonuse" through "renewal." In another example, through 10 years of research on the Apple Classrooms of Tomorrow (ACOT, 1996), conducted by Apple Computer, Inc., five stages of classroom technology integration were identified, from "Entry" to "Invention." Some research has found that the implementation process involves multiple iterative cycles. Ladewski, Krajcik, and Harvey (1994), for example, found through their work that teachers new to project based science go through repeated cycles of enactment, collaboration, and reflection. Given these findings, it is clear that the quantity and quality of PBL implementation is likely to evolve and cycle over a period of time. To learn more about PBL implementation patterns, therefore, it is useful to measure

intentions to implement, and reports of actual implementation multiple times over a significant period of time.

Given the theoretical framework described here, the current study examines the dynamic interaction between school conditions and teachers' motivational beliefs, how measures of these two sets of variables relate to PBL implementation, and how the measures change as teachers gain experience with PBL.

Study Purpose

Teachers are central to classroom instructional changes. Their willingness to change instructional practices is key to the success of reform efforts that strive to engage students, foster deep, meaningful learning, and support the development of twenty-first century skills through the implementation of PBL. A significant body of research indicates that willingness to invest in new practices is derived from the individual's interest in the innovation, a desire to engage students and help them achieve, and a positive sense of efficacy (Fullan, 2001). At the same time, the knowledge base has firmly established the important role played by the school's physical features and organizational structures in adoption of classroom innovation (Fullan, 2001; Hall & Hord, 2001; Lam, et al., 2010). Given the emerging growth of PBL in the K-12 school environment, educators must be equipped with substantive knowledge on sources of motivation in teachers' adoption of this complex pedagogy. However, research on the relationship of personal factors and teachers' perceptions of school conditions in regard to PBL implementation is quite limited. The purpose of this study, then, was to gain an understanding of how recently prepared PBL teachers' motivational beliefs (task value,

outcome expectancies and self-efficacy) and perceptions of school conditions relate to their PBL implementation, and how these factors and perceptions change as they gain PBL experience. These changes were determined with data comparisons between the first data collection point—immediately following an introductory PBL conference—and a second data collection point—several months into the school semester following the conference. Further, the study compared findings from teachers of New Tech Network schools, which utilize a whole school reform approach to PBL, with teachers who are primarily implementing individually, or in small teams. This comparison highlighted differences in perceptions, motivation, and implementation of teachers in different contexts. Additionally this study was designed to identify specific factors that teachers report as hindering or facilitating PBL implementation. Findings of this study will shed light on teachers' PBL motivational beliefs and how they relate to their perceptions of their schools' support of PBL. These data may be applied to inform the design of effective professional development experiences and a school environment that supports and leverages teacher motivation in their efforts to engage students, develop twenty-first century skills, and improve student outcomes through PBL.

To identify relationships among variables and potential explanatory value of some variables, this study employed a correlational design (Creswell, 2008). The data consisted primarily of teacher self-report data collected through multiple-choice questions and numerical entry of self-ratings on a scale of one to 100. These data were supplemented with qualitative data collected through open-ended survey questions as well as through telephone interviews with a small portion of the study population. Findings from

interview data were analyzed and applied to explain the "why" behind some of the relationships and patterns (or lack thereof) among the quantitative data.

Significance of the Study

PBL is not only aligned with 21st century skills and principles of learner-centered instruction, but it also shows potential for engaging students and providing a vehicle for academic success. Findings from multiple studies show that PBL is at least as effective as traditional methods for facilitating knowledge acquisition (Penuel, Means, & Simkins, 2000; Ross, Sanders, Wright, Stringfield, Wong, & Alberg, 2001), more effective for promoting critical thinking and problem-solving skills (Bartscher, Gould, & Nutter, 1995; Peck, Peck, Sentz, & Zasa, 1998; Tretten & Zachariou, 1995), more effective for improving performance on conceptual tasks (Boaler, 1997, 1998) more effective at developing flexible knowledge (Boaler, 1997), and more effective for retaining knowledge (Dochy, Mein, Van Den Bossche, & Gijbels, 2003). Further, studies have found PBL to engage students and help them learn how to learn (Marks, 2000; Newmann, 1991; Newman, Wehlage, Lamborn, 1992; Ryan & Connell, 1989).

Given its potential for transforming teaching and learning, PBL is rapidly becoming an integral part of reform movements in the K-12 environment in the U.S., and internationally as well. In 2007, Markham estimated that 2000 schools were using PBL (personal communication, as cited in Wurdinger, Haar, Hugg, & Bezon, 2007). While the number of schools or teachers actually relying on PBL as a primary methodology is difficult to pin down, it has undoubtedly grown since 2007. Indicators of recent PBL growth include the recent statewide initiatives in states like West Virginia (West Virginia

Department of Education, 2012). Schools throughout the country are also adopting reform models based on PBL, such as Expeditionary Learning, New Tech Network, and High Tech High. Expeditionary Learning began in 1992 and is now supporting over 45,000 students in 165 schools in 30 states (Expeditionary Learning, 2012). New Tech Network, which was founded in 1996, currently supports 86 public high schools in 16 states (New Tech Network, 2012). Their largest growth year was 2010, when 27 new schools were opened. High Tech High started as a single charter school in 2000 and now supports 11 schools in San Diego County, California (High Tech High, 2012). While these PBL schools make up a very small portion of the 99,000 public schools in the U.S. (U.S. Department of Education, 2011), the growth indicates a trend.

Many other organizations are also providing PBL training, support, and resources, including BIE, the Center of Excellence in Leadership for Learning (CELL), Big Picture Schools, and Apple Computers (2011). BIE—a provider of PBL training for teachers and administrators—uses the number of educators they train in PBL and the number of PBL workbooks they sell as partial indicators of PBL interest. During the 2009-2010 fiscal year, BIE trained more than 3,800 educators and sold approximately 9,000 of their handbooks and starter kits (J. Ravitz, personal communication, July 31, 2011). During 2010-2011 fiscal year, BIE estimates that they trained over 5,000 educators from 18 districts and sold approximately 18,000 handbooks and starter kits. PBL is also becoming a core practice in the small school movement. "Among schools in the Bill & Melinda Gates Small Schools Initiative that reported efforts to implement a common pedagogy

across all classes, project based learning (PBL) is the most commonly cited instructional strategy" (American Institutes for Research & SRI International, 2005, p. 65).

Despite the growing interest in PBL, implementation of this pedagogy does not come without challenges. The more open-ended, dynamic, and student-centered format of PBL holds more complexity for teachers than does the direct transmission of knowledge, which is more prescriptive, linear, and teacher-directed (Darling-Hammond, 2008). Additionally, most teachers lack knowledge and skills in the PBL methodology (Ball & Cohen, 1999; Lam, et al., 2010; Smith, 1996), and many have reported a number of concerns related to PBL and other learner-centered approaches, including risk of off-task students interrupting other students' learning (Ladewski, et al., 1994), the belief in the teacher's role to transfer facts to the students (Gunel, 2008), and pressures to ensure students are prepared for content-focused high stakes tests (Pederson & Liu, 2003). While some teachers are able to successfully overcome the hurdles of change and persist through the associated struggles, others may be reluctant to try new practices, or may revert to more familiar and comfortable practices after initial attempts. According to Roehrig, Kruse, and Kern (2007), even pre-service teachers who begin their practice with student-centered beliefs tend to revert to traditional practices when faced with classroom realities.

Challenges to implementing constructivist, learner-centered pedagogies are not new. Windschitl (2002) outlined a history of failed attempts at school reforms involving "progressive pedagogies" (which have instructional philosophies closely resembling constructivism), from the late 1800's through the 1950's. According to Windschitl,

educators such as Parker, Parkhurst, and Dewey led reform efforts, based on child-centered theories, to emphasize learning in context, appealing to students' interests, making learning social, and building on students' prior knowledge. Those efforts largely failed to take hold. Given this history, it is reasonable to assume that PBL may meet a similar fate if educators are not equipped with the knowledge and understanding they need to provide the necessary organizational and teacher supports.

A number of case studies and small-scale survey studies have been conducted and have been valuable in bringing to light the challenges and struggles that teachers encounter as they work to implement PBL and similar pedagogies (Baumgartner & Zabin, 2008; Ertmer & Simons, 2006; Ertmer, Glazewski, Jones, Ottenbreit-Leftwich, Goktas, Collins, & Kocaman, 2009; Glazewski & Ertmer, 2010; Ladewski, et al., 1994; Marx, et al., 1997; Toolin, 2004). However, the research on what motivates teachers to persist with PBL, or take on this innovation in the first place, is quite limited. This study seeks to identify factors related to teachers' motivation to implement PBL. These data are important for educators who wish to break the patterns of failed attempts to instill learner-centered instructional practice and foster sustained success. This may be done with a better understanding of how specific school supports and beliefs about PBL relate to teacher motivation. This study may also inform how both personal motivational beliefs and perceptions of school conditions relate to implementation of other classroom innovations as well.

The literature on teachers' perceptions of school conditions and how these perceptions relate to motivational beliefs and PBL implementation are limited. Therefore,

this study will investigate these relationships. This study brings value because it recognizes the influence of both teacher motivational beliefs and perceptions of school condition as two dynamic sets of factors that not only influence motivation and implementation, but also influence each other. This information may be useful to educators working to implement PBL, and to others who are interested in implementation efforts in general. This study also bring value because it involves two separate data collection points—one at the conclusion of an introductory conference to PBL, and one after several months of time to implement PBL—that provide an opportunity to see how perceptions may change over time, as teachers gain PBL experience. Data comparisons between the two data collection points highlight the difference between intended use of the innovation and actual use of innovation, as well as how task value, outcome expectancy, and self-efficacy change as the teacher moves from imagining what it will be like to work with PBL to actually working with PBL. Further, the study highlights differences that exist in teacher motivational beliefs, perceptions of school conditions, and implementation activities between teachers in schools utilizing the whole school reform model of New Tech Network. Additionally, with the use of open-ended questions and interviews, insight was gained into why respondents answered the way they did. Finally, while many studies of educational innovation implementations assess teachers' intention to implement, this study includes actual implementation, as defined by self-report data.

Research Questions

The specific research questions to be addressed by this study are:

1. How do newly prepared PBL teachers in New Tech Network schools compare with those in non-New Tech Network schools in self-efficacy, outcome expectancy, task value, perceptions of school conditions, and extent of PBL implementation?
2. What is the role of newly prepared PBL teachers' motivational beliefs, perceptions of school conditions, and PBL experience in the extent of PBL implementation?
3. How do newly prepared teachers' motivational beliefs, perceptions of school conditions, and intention to implement PBL reported immediately after introductory PBL training compare with their motivational beliefs, perceptions of school conditions and extent of implementation during the first two months of school following the PBL training?
4. What do newly prepared PBL teachers report as factors that impacted implementation and motivation during their first two months of implementation efforts?

Definitions

Definitions of terms used for the purpose of this study are provided below. While there are a number of other terms that may be found in the literature related to teacher motivation, classroom implementation, and school change, the definitions provided here are those that are central to the study.

PBL is "a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex,

authentic (real-life) questions and carefully designed products and tasks" (Buck Institute for Education, 2003, p. 4).

Outcome expectancy describes the consequences that one expects as a result of performing a task at the expected level of competence (Bandura, 1986).

PBL Implementation is the enactment of PBL teaching and learning processes.

School conditions are physical, organizational, and cultural features of a school that may hinder or support implementation of educational innovations, such as PBL. School conditions reported to impact PBL implementation include level of support from administration and colleagues, amount of teacher planning time, length of class periods, flexibility of curriculum, level of access to PBL experts, level of access to technology and resources, and appropriateness of classroom facilities (Ravitz, 2010; English, 2011; Bradley-Levine, et al., 2010).

Self-efficacy is the belief in one's capability to perform a given task at a certain level (Bandura, 1997).

Task value is derived from three separate value perceptions: 1) attainment value, or the importance of doing well; 2) intrinsic value, or enjoyment; 3) utility and personal costs or sacrifices (Wigfield & Eccles, 2000).

In the following chapter, a review of the relevant literature is presented. The review is organized into the following sections: Definition of PBL, PBL and 21st Century Skills, PBL and Teacher Challenges, PBL and Student Challenges, How PBL Works, PBL Teaching Principles, Factors Affecting a Teacher's Decision to Implement,

Motivational Beliefs and Classroom Implementations, School Conditions and Implementation. In chapter three, the methods are described, including the rationale.

2. Literature Review

The review of literature was designed to establish a base of knowledge about implementation issues related to PBL, as well as motivational and school support issues related to other classroom innovations, and to identify research gaps. The following databases were included in the search: Academic Search Complete, Dissertations and Theses: Full Text, Education Research Complete, Eric, JSTOR, PsycInfo, Psychology and Behavioral Sciences Collection, and Teacher Reference Center. Searches were limited to peer reviewed articles published between 2000 and the 2012. Various combinations of the following key words and key phrases were utilized in searches: PBL, project based learning, problem-based learning, project based science, project based instruction, task value, outcome expectancy, self-efficacy, teacher motivation, implementation, innovation, student-centered, learner-centered, constructivist, school change, school support, and school conditions.

The review is organized into the following topics: Definition of PBL, PBL and 21st Century Skills, PBL and Teacher Challenges, PBL and Student Challenges, How PBL Works, PBL Teaching Principles, Factors Affecting a Teacher's Decision to Implement, Motivational Beliefs and Classroom Implementations, School Conditions and Implementation.

PBL Defined

Over time, a variety of pedagogical models, like PBL, have emphasized learning in context. In *Democracy and Education*, Dewey (1916) described a vision for education in which schools would mirror the larger society and classrooms would be laboratories for real-life inquiry and problem solving. In 1918, Kilpatrick articulated a pedagogy called "the problem method" (Kilpatrick, 1918). In the late 1960's Harold Barrows implemented a problem-based learning model to enable medical students at McMaster University to apply content knowledge in clinical settings through problem solving (Barrows, 1985). Since then, other models of problem-based learning have been developed by the Cognition and Technology Group at Vanderbilt, Krajcik and Czerniak, Slavin, Madden, Dolan, and Wasik (Arends, 2009). Several non-profit educational organizations have developed their own brands of project based learning as well, and work with schools to implement their model. For example, BIE has developed handbooks, workshops, and coaching services that they offer to educators to implement their "standards-based PBL" model (Buck Institute for Education, 2003). A Driving Question (authentic problem) is central to BIE's model, and serves to establish a "need to know" the content required by state standards. Expeditionary Learning, a nonprofit chartered by Outward Bound, offers a PBL model rooted in experiential learning (Expeditionary Learning, 2012). Their "learning expeditions" use an interdisciplinary approach and heavily emphasize not only student engagement and achievement, but also character development. The Expeditionary Learning organization works with schools to implement a comprehensive school reform approach based on learning expeditions. The

New Tech Network is another non-profit organization that partners with schools to implement PBL as part of comprehensive school reform. With an emphasis on innovation, technology is an integral part of New Tech's PBL model, as each student is equipped with a laptop, and students and teachers are networked through a proprietary collaborative learning system (called ECHO), which they use for communicating and sharing both project plans and project work (New Tech Network, 2012). While there are subtle differences in practices prescribed for enacting these PBL models, they share core principles. In all three models, the project provides a context for learning content; learning takes place through the process of inquiry and the development of artifacts that are shared with an audience beyond the classroom; the teacher is a *facilitator* of learning while students are expected to take responsibility for their learning; students work collaboratively; along with development of content knowledge, skills such as problem solving, critical thinking, and communication are emphasized. The PBL process is explicated in more detail later.

Project based learning, problem-based learning, project based instruction, project based science, inquiry-based learning, and design-based learning are all examples of student-centered, inquiry-based models for learning in which students go beyond textbooks and lectures to construct their own meaning (Thomas, 2000). Because the features that distinguish these approaches are relevant only to the specific processes, and not the overall conceptual approach, studies of these variations of inquiry-based learning were also in included in this review.

How PBL Works

PBL projects range in scope and complexity; while some may be as brief as one or two weeks, others may last an entire school year. Projects may be limited to one subject and one classroom or they may be interdisciplinary and involve a team of teachers, as well as community participation (Buck Institute for Education, 2003). PBL engages students in a series of complex tasks centered on a driving question—also called an Essential Question or Problem Statement (Mergendoller, Markham, Ravitz, & Larmer, 2006). These tasks include planning and design, problem solving, decision-making, creating artifacts, and communicating results. Students work together in groups and are responsible for making their own meaning and managing their own learning process throughout the project.

PBL is based on constructivist theories of learning, which posit that learners actively construct meaning, rather than acquired knowledge in a passive manner (Schraw, 2006). Two major contributors to the development of constructivist theories of ways of knowing are Piaget and Vygotsky.

Piaget's cognitive constructivist theory, posits that humans seek to maintain equilibrium or balance in the cognitive system (Piaget, 1985). This equilibrium is disrupted when an individual experiences new objects and events in the environment that cause a change in an existing cognitive structure (schema). The brain seeks to restore equilibrium in cognitive structures through processes of expansion and transformation referred to as assimilation and accommodation. Assimilation is an expansion process that involves fitting new information onto existing schema—or, matching external reality to

internal reality. Accommodation, on the other hand, is a transformational process that involves changing existing schema to fit newly discovered information. To support this theory of learning, then, the learning environment should be designed to create opportunities for the student's cognitive equilibrium to be "disrupted," prompting assimilation or accommodation of new understanding.

Vygotsky's (1978) work shares the core tenets of cognitive constructivism, but diverges with its emphasis on the social nature of learning, making it part of the branch of study referred to as social constructivism. According to Vygotskian theory, social interaction and the environment (including tools, technologies, cultural beliefs, values, and practices, for example) serve as the basis for cognitive development, with knowledge being constructed in a social context before being adopted at the personal level). One of Vygotsky's key theories suggests that individuals have a "zone of proximal development," which is defined as the difference between an individual's current ability and the individual's potential with the assistance of a more knowledgeable other. This suggests that communication in a social setting with more knowledgeable or proficient others facilitates the learner's development. According to this theory of learning, it follows that the educational experience should emphasize social interaction, placing learners with those who will be able to assist with their development, offer the appropriate level of challenge, and provide scaffolds.

Reflecting the tenets of constructivism put forth by Piaget (1985) and Vygotsky (1978), Bransford, Brown, and Cocking (2000) made the claim that the "new science of learning" accepts humans as goal-directed, active seekers of knowledge who bring with

them to the classroom a set of prior knowledge, skills, beliefs, and concepts that filter their perceptions of the environment and shape how those perceptions are interpreted and organized. Further, the authors suggested that if students' prior understanding is not engaged, they may fail to grasp or internalize new knowledge and concepts.

PBL activities conducted by students may be separated into three main phases: 1. Project Launch, 2. Guided Inquiry and Product Creation, 3. Project Conclusion (Mergendoller, Markham, Ravitz, & Larmar, 2006). During Project Launch, students gain an understanding of the learning goals and process goals. The driving question prompts students to think about what they already know about the topic and to determine what they need to know in order to answer the question. The gap between what they know and what they need to know drives the plan for inquiry. The teacher supports this process by explaining the goal, providing sample products, setting expectations for roles and responsibilities, providing resources, templates, and activity structures, and modeling learning strategies.

Phase 2, Guided Inquiry and Product Creation, involves iterative cycles of gathering information, making meaning, reflecting and testing findings (through evidence checking, experimentation, logic and reason, and input from peers and the teacher), and revising as needed (Mergendoller, et al., 2006). The teacher supports incremental learning by providing scaffolds, feedback, guidance on learning content and processes, and with purposefully designed activity structures. Eventually, students apply their findings to create a final product that not only answers the driving question, but also demonstrates conceptual understanding. The integrated use of technology during this

stage can be beneficial to students and the learning process, but it is not a requirement for PBL.

During Phase 3, Project Conclusion, students reflect on the overall learning outcomes and process outcomes, as related to the goals and expectations (Mergendoller, et al., 2006). As students share their products with the teacher, peers, and sometimes an outside audience, they continue to learn through other students' work, by comparing and contrasting their own findings with those of other students, and from feedback and questions they receive from the audience.

PBL and 21st Century Skills

The Partnership for 21st Century Skills (P21) is a national organization of business, education, and industry members, that advocates for "21st century readiness for every student" (Partnership for 21st Century Skills, 2011). Their strategic council members include educational organizations like the National Education Association (NEA) and Knowledge Works Foundation, and businesses such as Apple and Blackboard. According to P21, 21st century skills include mastery of core subjects, creativity and innovation, critical thinking and problem solving, communication and collaboration, information literacy, media literacy, information and communication technology (ICT) literacy, and life and career skills, such as initiative, self-direction, productivity, and social skills (Partnership for 21st Century Skills, 2011).

Several well-known authors in the business field have made a strong case that these skills are critical in today's workplace to accommodate the dramatic changes brought about by the information age and the global economy. Drucker (1999) contrasted

the 20th century emphasis on manual worker productivity in manufacturing with the 21st century emphasis on knowledge worker productivity in business and non-business, and explains the imperative for individual knowledge workers to have autonomy, to innovate, to be continuous learners, and to raise the level of emphasis on quality to at least match that of quantity. Similarly, Friedman (2005) described how the convergence of the personal computer, fiber-optic cable, and work flow software have given individuals unprecedented capabilities to author their own digital content, to access limitless volumes of digital content in the blink of an eye, and to collaborate in real-time with others anywhere in the world. According to Friedman, these conditions call for individuals to develop not only a new set of skills, but also greater self-reliance, creativity, and innovation.

Politicians, business leaders, and educators have called for school reforms that reflect the needs of the "flattened" high tech world that these authors describe. President Obama, for example, has urged states to develop standards that measure whether students possess 21st century skills:

> We don't need to know whether a student can fill out a bubble. We do need to know whether they're not only mastering reading, math, and science, but also developing the kinds of skills, like critical thinking and creativity and collaboration that I just saw on display with the students that I met here. Those are skills they're going to need for the rest of their lives, not just to be good workers, but to be good citizens. (U.S. Department of Education/Blog, 2011)

The Partnership for 21st Century Skills has claimed that a profound gap exists between the knowledge and skills that most students learn in school and the knowledge and skills they need in today's workplace (Partnership for 21st century Skills/About us, 2011). Darling-Hammond (2008) stated that the new demands of society cannot be met through passive, rote-oriented learning focused on basic skills and memorization of disconnected facts. Wagner (2008) contended that the world has changed, while our schools have not—making schools obsolete.

The learning activities that are the essence of PBL are closely aligned with 21st Century skills. Table 1 illustrates the alignment between key learning processes from BIE's description of PBL (2003) and the skills outlined by P21 (2011), highlighting the relationship between the processes and skills. This table was created using a concept mapping process.

Table 1

PBL Learning Processes and 21st Century Skills

PBL Learning Processes	Related 21st Century Skills
Planning and design	Initiative Productivity
Problem solving and decision-making	Problem solving Initiative Critical thinking
Making their own meaning	Initiative Self-direction Mastery of core subjects Critical thinking

Creating artifacts	Mastery of core subjects Creativity and innovation Information literacy Media literacy ICT literacy*
Communicating results	Communication and collaboration
Working together in groups	Social skills Communication and collaboration
Managing their own learning process throughout the project	Initiative Self-direction

* Integration of technology can enhance PBL and skills development; however, projects are often completed without technology integration.

PBL and Teacher Challenges

The implementation of PBL is a multi-faceted process—requiring changes in curriculum, instruction, and assessment practices (Barron, et al., 1998). Cohen (1988) notes that teachers who choose to implement PBL "must work harder, concentrate more, and embrace larger pedagogical responsibilities than if they only assigned text chapters and seatwork" (p. 255). Not only is PBL more complex, but classroom practices associated with it—including planning, classroom management, the roles of the teacher and students, the process of knowledge creation, and means of assessing student work—go against the grain of what most teachers learned in their pre-service programs, of how they learned themselves, and of what they have seen modeled (Ball & Cohen, 1999; Smith, 1996; Nelson & Harper, 2006; Pederson & Liu, 2003).

In PBL, as with other constructivist, student-centered pedagogies, instructional planning is less prescriptive; the teachers' role is to provide an appropriate learning environment rather than specific facts; the role of teacher is process facilitator rather than knowledge transmitter; the role of the student is active creator rather than passive recipient of knowledge; and assessment involves the use of rubrics to evaluate products rather than multiple choice tests of knowledge and understanding. Another challenge of PBL is that accountability pressures related to high stakes tests have resulted in more emphasis on rote memorization and less emphasis on activities that involve more complex reasoning, such as projects and research papers (Koretz, Linn, Dunbar, & Shepard, 1991; Linn, 2000; Linn, Graue, & Sanders, 1990). Such views were highlighted in a study documenting middle school science teachers' views on a student-centered learning environment (which has features resembling PBL) (Pederson & Liu, 2003). In this study, a middle school science teacher expressed the pressures that standardized tests can create:

> My school is totally [standardized test]-driven. We dropped a rating this year and you wouldn't believe what's going on about it, the things that are required about it. We are motivated by scores. The teachers aren't necessarily, but the school district's motto is your [standardized test] scores are everything. And that's not just [our district], that's the whole state. (p. 69)

Further, the teachers in this study expressed a belief that student-centered learning is effective at teaching students problem solving skills, but not effective in helping students learn factual knowledge needed for standardized tests.

Teachers lacking experience with project based science have reported that projects require too much time, the class feels disorderly, they feel they are unable to control the flow of information, that they have difficulty balancing giving students independence and providing them supports, and difficulty incorporating technology as a cognitive tool, and difficulty designing assessment (Marx, Blumenfeld, Krajcik, & Soloway, 1997). Some of these teacher struggles were exemplified in a case study documenting a middle school science teacher's initial efforts to implement a pre-packaged six-to-eight-week PBL unit (Ladewski, et al., 1994). The teacher (Connie) faced a steep learning curve as she learned about the structure and requirements of the unit, developed new procedures and strategies for classroom management, learned how to perform necessary computer functions, and dealt with limited classroom facilities. The researchers reported that Connie held a view of herself as content expert, which led to a more directive approach that emphasized helping students find the correct answers. Connie believed that her primary role as teacher was to direct the classroom, and that one of her main tasks was to cover the science content as outlined in the standard curriculum.

A number of additional case studies highlighting these challenges have been conducted with PBL, problem-based learning, project based science, and learner-centered computer environments. Ertmer and Simons (2006), for example, examined how teachers may "jump the PBL implementation hurdle"; Pedersen and Liu (2003) investigated

teachers' beliefs about student-centered learning as they struggled to implement a computer-based student-centered learning environment; and Toolin (2004) observed science teachers as they worked to balance adopting inquiry learning with meeting requirements of state learning standards. Larger studies of PBL implementation (including problem-based learning, project based instruction, and project based science) are quite limited.

PBL and Student Challenges

In PBL learning environments, knowledge is not transmitted to students from the teacher, but rather, constructed by students through their questioning, active learning, sharing, and reflection. Therefore, teachers are not the only members of the classroom who experience challenges with PBL; students are also required to make major adjustments in the role they play in the learning process and how they go about learning. Students in PBL are expected to be self-directed and to take responsibility for managing the learning process. Blumenfeld, et al. (1991) found that students in PBL needed to "be far more responsible for guiding and controlling their own activities and focusing their work on the creation of artifacts over a long period of time" (p. 379). To do this effectively, it is clear that students in the PBL environment must be able to motivate themselves, focus their efforts and attention appropriately, monitor and evaluate their progress, and seek help as needed. In other words, students must become self-regulated, employing processes such as goal setting, self-monitoring, and self-evaluation (Zimmerman, 1989). Level of self-regulated learning (SRL) describes the extent to which learners are metacognitively, motivationally, and behaviorally active participants of their

own learning process (Zimmerman, 1989). According to Brush and Saye (2001), the shift in responsibility for learning does not occur naturally or easily for students. Due to lack of experience and knowledge with self-directed learning, students may become confused or frustrated if they do not receive the support or guidance needed to be successful (Ertmer & Simons, 2006).

Social cognitive theory holds that student self-regulation is a developmental and situational skill that is largely impacted by the learning environment and teaching practices. Research has provided evidence that teachers can teach students these skills through the intentional design of both learning activities and communication patterns (Barron, Schwartz, Vye, Moore, Petrosino, Zech, Bransford, 1998; Kitsantas, 2002; Peters, 2010; Polman, 2004; Zimmerman, 2008). However, teachers may not have received education or training in how to do this.

Teaching Principles for Effective PBL

While PBL has shown promise as an effective teaching methodology, simply doing projects is not enough to ensure that students are learning. Some past efforts at implementing project approaches have failed to produce learning due to a focus on activity over learning. To ensure "doing with understanding" rather than just "doing," (Blumenfeld, 1991; Schauble, Glaser, Duschl, Schulze, & John, 1995), the teacher must provide appropriate learning goals and structures, structures, guidance, and coaching to ensure that students meet the intended learning goals, develop the desired skills, and are prepared for standardized tests.

A group of researchers shared design principles and lessons learned from their collaborative work with teachers in planning and evaluating problem and project based learning (Barron, et al., 1998). In recognition of the complexities of teaching effectively with PBL and a desire to promote "doing with understanding," the researchers sought to identify practices that contribute to student learning in the PBL environment. The article discusses four principles for designing, implementing, and evaluating problem and project based curricula, the rationale behind each of the principles, and examples of the principles in practice. The principles are: 1) defining learning-appropriate goals that lead to deep understanding; 2) providing scaffolds; 3) ensuring multiple opportunities for formative self-assessment and revision; and 4) developing social structures that promote participation and a sense of agency. The researchers suggest that these principles are mutually supportive toward student acquisition of content and skills and, simultaneously, the development of students' responsibility and ownership of their learning.

The first design principle presented in by Barron, et al. (1998) relates to constructing learning-appropriate goals. The researchers claim that the driving question upon which a project is based must be well-crafted to make connections between activities and the underlying conceptual knowledge that the project is intended to produce. When the driving question is well-formed, the researchers suggest, it serves as a learning goal that clarifies for students what they are to learn, thereby helping them direct their learning. Further, the researchers state that without an explicit and appropriate goal connecting the concepts and the activity, "the 'doing' of an activity takes precedent over 'doing with understanding.'" Given the constructivist assumption that learners come to

the classroom with existing knowledge, skills, values, and beliefs, it makes sense that learning-appropriate goals—or well-formed driving questions—would be necessary to focus student attention on particular information.

The second design principle presented by Barron, et al. (1998) is supporting student learning through scaffolds. According to the researchers, scaffolding was originally defined as "a process that helps a child or a novice to solve a problem, carry out a task, or achieve a goal which would be beyond his unassisted efforts" (Wood, Bruner, & Ross, 1976). The concept of scaffolding supports Vygotsky's Zone of Proximal Development theory (Vygotsky, 1978). Scaffolds, as Barron, et al. (1998) use the term, seem to support constructivist views of learning, as they help students see the relevance of their learning to the big picture, support inquiry skills to advance understanding, and encourage reflection on one's ideas in relation to those of others. Scaffolds may be viewed as just-in-time supports for learning, embedded in learning activities. Students assigned the project of designing a blueprint for a child's playhouse, for example, may come to the assignment with little or no knowledge of related concepts such as measurement, determining area, and drawing to scale. Rather than teaching these concepts up front, this information is taught through scaffolds that are embedded in the project, available to students in context, when they are ready to apply those concepts. Direct instruction, guided review, checklists, rubrics, and other such guides are examples of scaffolds.

The third design principle described in the article is the provision of frequent opportunities for formative assessment and revision (Barron, et al., 1998). Formative

assessments, as described in this article, are purposefully designed activities that inform the teacher about what students are and are not learning so that he or she may adapt instruction and provide appropriate guidance, coaching, and feedback. According to the authors, formative assessments can also be designed to inform students about their own learning, which enables them to see where they need to focus or adjust efforts, and develop their ability to self-monitor—both of which are aligned with constructivist learning theory. Multiple cycles of formative assessments were conducted during the blueprint project. During each cycle, students received feedback on their blueprints from self-evaluation, teacher review, or peer review. Rather than correcting the students' work, or giving them the answers, teacher feedback pointed to areas where the students needed to rethink their approach or concepts they needed to review. Peer review raised questions and offered suggestions. The feedback not only helped students deepen their understanding of the related concepts; it prompted them to reflect, to construct their own knowledge, and to maintain responsibility for learning. Additionally, providing peer review gave students another avenue for deepening understanding.

Multiple cycles of formative assessment demonstrate the iterative, process-oriented nature of learning. Rather than students receiving a large chunk of new information in advance of the project, and trying to apply the information all at once, they receive information in increments. Multiple reviews and feedback at various points over the course of the project enables the student and the teacher to identify current understandings and progress as well as guidance on how to move forward in the sense-making process.

The fourth design principle the researchers proposed is careful attention to the social organization of the classroom to promote student participation and a sense of agency (Barron, et al., 1998). Establishing group norms, requiring each individual to demonstrate understanding before moving on, and creating small group interactions and opportunities to contribute are suggested practices. In addition, the researchers report the importance of designing performance opportunities in which students present their ideas to outside audiences. Such experiences have been found to open students to other perspectives, a wider variety of feedback, and help students learn different ways to communicate their ideas. In the case of the example blueprint design project, students worked in groups, with expectations that each group member would need to participate. An outside group of evaluators were brought in for final presentations so add authenticity and to raise the stakes. This arrangement also created a dynamic that allowed the teacher to serve as a facilitator of learning, working alongside students, rather than being in an authoritarian role.

A case study (Peters, 2010) illustrated how these learning supports were enacted during a seventh grade inquiry based science unit. Students in this project conducted a review of the literature on genetics, developed their own questions about the subject based on the review along with their existing knowledge, conducted inquiry to find evidence to answer the questions, and then took on various roles in a mock trial to present and argue findings from the perspective of judge, lawyer, or genetics expert.

The authentic structure for the project was the mock trial. During the trial, students presented arguments and challenged each other's claims. The teacher

encouraged students to develop their ideas throughout their inquiry by making observations and looking for connections. The learning was scaffolded by independent research, Socratic seminars, presentations, peer review, and by the teacher's monitoring of progress and asking probing questions. Each of these activities was designed to help students reach their ultimate goal of performing in the culminating activity.

Students constructed knowledge by developing their own questions and conducting research to find answers. They learned to use evidence, logic, and peer review to gain support or identify holes in their answers. Students also learned through making mistakes and reviewing the resulting discrepancies. As students identified where they went wrong in their thinking, they deepened their content knowledge as well as their metacognition. This case study presented one example of what a project looks like in the classroom.

Factors Affecting a Teachers' Decision to Implement

Over time, the question of what factors hinder or facilitate teachers' implementation of innovative or unfamiliar instructional practices has been a significant line of inquiry, due to concerns that change does not happen quickly enough (Cohen, 1988), does not happen according to design (Rogers, 2003), or does not happen at all (Cuban, 1983). Gess-Newsome (2003) and Feldman (2000) emphasized the importance of teachers' desire to change, claiming that teachers have to make the decision to change for classroom reform to take place. Gess-Newsome (2003) argued that individual change is the foundation of systemic change.

Given their direct influence on what happens in the classroom, teachers have been the focal point of volumes of research examining such variables as teacher beliefs (Nespor, 1987; Pajares, 1992), attitudes (Avidov-Ungar, 2010), teaching philosophy (Briscoe, 1991; Rich, 1990), concerns (Hall, Wallace, & Dossett, 1973), self-efficacy (Guskey, 1988), and others, in search of a better understanding of factors that influence teachers' decision to adopt new teaching approaches, strategies, and technologies. According to the Diffusion of Innovations model (Rogers, 2003), once an individual receives a new idea, they progress through five stages: knowledge, persuasion, decision, implementation, and confirmation. The central question of this study is what factors come into play at the decision stage.

Fullan, who has been researching educational change and implementation since 1991, and is recognized internationally for his contributions (Fullan, 2012), has concluded that change is a highly personal experience. He points to several decision-making criteria and sense of efficacy as being the motivating factors in the decision to put their efforts into a particular change (2001).

Fullan's first decision-making criterion addresses whether the change fills a need: "Will students be interested? Will they learn? Is there evidence that the change works, i.e., that it produces the claimed results?" (Fullan, 2001, p. 127) These questions are aligned with the construct of outcome expectancy (Bandura, 1986). Outcome expectancy describes the consequences that one expects as a result of performing a task at the expected level of competence (Bandura, 1986). Aligned with Fullan's research findings, this theory holds that expectations influence one's decisions regarding how and where to

exert efforts and focus energies. According to Bandura, expected outcomes have been shown to be more of a factor in motivation when the outcomes are not controlled by the individual's performance quality (1989). When a high level of performance is viewed as having a direct link to results, then there is much overlap in self-efficacy and outcome expectancies; however, when the individual does not necessarily believe that a high level of performance will bring about the desired results, then measures of outcome expectancy tend to deviate from measures of self-efficacy. In practice, this means that if a teacher views student motivation as an inherent characteristic of a student, then the teacher could have high self-efficacy for her own ability to perform well as a teacher, and yet still have low outcome expectancy for students. In relation to PBL, the literature suggests that some teachers may view PBL as an ineffective way for some students to learn, due to concerns about poor attendance, low levels of engagement, and students' ability to manage their own learning. Some teachers have also expressed a lack of certainty that PBL and other learner-centered approaches are effective in teaching the content required on state assessments (Ladewski, et al., 1994; Mitchell, Foulger, Wetzel & Rathkey, 2009; Pedersen & Liu, 2003; Toolin, 2004). According to the research on outcome expectancy and willingness to adopt new classroom practices, these low expectations for student success could play a role in teachers' decision to implement PBL.

Other criteria identified by Fullan are "How will it affect the teacher personally in terms of time, energy, new skill, sense of excitement and competence, and interference with existing priorities?" and "How rewarding will the experience be in terms of interaction with peers or others?" (Fullan, 2001, p. 128). Both of these criteria align with

the construct of task value (Wigfield & Eccles, 2000). Task value is comprised of three separate components: 1) attainment value, or the importance of doing well; 2) intrinsic value, or enjoyment; 3) utility and personal costs or sacrifices (Wigfield & Eccles, 2000). Using logic to apply this theory to PBL, this means that teachers who believe it's important to be successful with PBL—that is, good for their career, good for the school, or good for students, those who enjoy PBL, and who see the gains as greater than the personal costs are more likely to commit to PBL implementation. Personal costs may include the time, energy, and risk-taking associated with learning and implementing PBL.

In addition to whether students will learn and what the change will require from teachers, an additional factor that Fullan (2001) has identified as playing a role in teachers' commitment to an innovation is sense of efficacy. Fullan views sense of efficacy as a result of several factors, including personality, previous experiences, level of self-actualization, and stage of career. He also highlights that the school culture or climate plays a significant role in shaping sense of efficacy (2001)—an important point when studying the role of motivational beliefs and environmental factors in motivation—as it suggests that teachers in school cultures they perceive to be more supportive may have higher self-efficacy.

Sense of efficacy may be aligned with the construct of self-efficacy, which Bandura defines as the belief in one's capability to perform a given task at a certain level (Bandura, 1997). Bandura asserts that "People's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true" (p. 2). According to the theory of self-efficacy, higher self-efficacy in a specific context leads to

more focus, determination, and willingness to experiment. This notion is supported by research, which has shown that efficacy affects the effort teachers invest, the goals they set, and their level of aspiration (Tschannen-Moran & Hoy, 2001). Additionally, teachers with high teacher efficacy (a construct based on the concept of self-efficacy) have been shown to be more open to new ideas and more willing to experiment with new methods (Tschannen-Moran & Hoy, 2001). Applying the theory to PBL means that teachers with high levels of self-efficacy in PBL-related teaching skills may be more receptive to the unfamiliar concepts and processes associated with PBL and more likely to take on the challenges of the steep learning curve and complexities that come with the change.

Motivational Beliefs and Classroom Implementations

Task value, outcome expectancy, and self-efficacy are motivational constructs that align to Fullan's personal motivational criteria in a teachers' decision to invest in the change associated with adopting an innovation. While studies of these specific constructs in relation to PBL implementation were not found, several studies of these constructs in other challenging implementation efforts were identified. The implementations included new integration of technology, cooperative learning, and a reading strategy. Reviewing findings and methods of these studies is valuable in framing the role that these constructs may play in PBL implementation.

A 2008 study surveyed 348 science teachers from 40 middle schools in the central region of Taiwan on several factors related to intrinsic motivation and intention to infuse instructional technology into their teaching practices (Wu, et al., 2008). The purpose of the study was to identify relationships among multiple intrinsic motivation variables, and

to determine relationships between these variables and teachers' reported intention to infuse technology into their teaching practices. The relevance of this study to the current study stems from an assumption that teachers' challenges with PBL implementation resemble those associated with technology integration. Also, two of the motivational beliefs investigated—perceived usefulness and self-efficacy—are aligned with those of the current study.

The study by Wu, et al. (2008), which was based on the Technology Acceptance Model (TAM), employed the constructs of perceived usefulness, perceived ease of use, perceived fit, computer self-efficacy (CSE), and intention to infuse. The basis of the study is the authors' assumption that these variables are interrelated, and that perceived usefulness, perceived ease of use, and computer self-efficacy predict behavioral intention, which in turn predicts actual usage. The authors utilized validated measures from prior studies utilizing TAM and the Task-Technology Fit (TTF) model. They conducted additional validation testing as well, with 10 pre-selected science teachers who were experienced with instructional technologies. The final survey contained three items for perceived usefulness, three items for perceived ease of use, four items for perceived fit, three items for CSE, and two items for intention to infuse. The survey utilized a 7-point Likert scale, from strongly disagree (1) to strongly agree (7). The authors state that one-third of the items were negative expressions, to avoid a potential ceiling effect; however, this was not evidenced by the copy of the survey provided in the appendix. All items shown there were positively worded.

The survey was delivered online and questions were randomized. A total of 226 usable responses were obtained (response rate of 65%). The respondents were diverse in specific science subjects taught as well as gender and years of teaching experience. The results of their tests of internal reliability, discriminant validity, and convergent validity of the instrument indicate that the instrument was reliable and valid. All Cronbach's alpha values exceeded .8, one the five constructs of interest were extracted with loadings greater than .7. The factor matrix of loadings and cross-loadings showed that the smallest standardized correlations were higher than any other items correlated to the same factor, indicating convergent validity.

Structural equation modeling was utilized to test the hypothesized model (Wu, et al., 2008). Of the four predictors analyzed, perceived usefulness demonstrated the highest influence on intention to infuse ($\beta = 0.48$, $p < .001$) and CSE had the second highest influence ($\beta = .41$, $p < 0.001$). Together, these two variables accounted for 66% of the variance on intention to infuse. These findings provide evidence of the significance of perceived usefulness (a construct closely related to task value) as well as self-efficacy as predictors of implementation. Because no open-ended questions were included on the survey, respondents did not have a means of providing additional information about the sources of their intention to use technology in their science classes.

A 2004 study examined multiple motivational factors differentiating users and non-users of a cooperative learning (CL) strategy, which the researchers described as an educational innovation (Abrami, Poulsen, & Chambers, 2004). According to the researchers, despite evidence that CL promotes student achievement and the development

of social and interpersonal skills, estimates of sustained use of CL among teachers vary from 10% to 93%. As with implementations of other educational innovations, the nature and quality of CL implementation also appears to be highly variable. The purpose of the study was to identify factors that predict teachers' use of CL.

The study was reportedly based on expectancy value theory, which includes the three components, value, expectancy, and costs (Abrami, et al., 2004). Value in this case was defined as the degree to which teachers perceived the innovation or its associated outcomes as worthwhile—including benefits for the teacher and for the students. This is similar to the utility component of the task value construct. Expectancy items measured teachers' perceptions of the contingency between their use of the strategy and the desired outcomes. This definition is closely aligned with the definition of outcome expectancy in the current study. Cost items measured perceived physical and psychological demands of the implementation. This definition coincides with the cost component of the task value construct.

The copy of the survey provided in the appendix shows loose interpretation of the stated definitions in item creation (Abrami, et al., 2004). For example, "I understand cooperative learning well enough to implement it successfully" is cited as a measure of expectancy (p. 214). However, this item seems to be more closely aligned with the definition of self-efficacy than expectancy. While self-efficacy is concerned with one's own performance, expectancy is concerned with the potential outcomes of a specific level of performance (Bandura, 1997). In another example, "Cooperative learning contradicts parental goals" is labeled a measure of value. However, this item does not seem to be a

direct measure of value; rather, it seems to measure a condition—contradiction with parents' goals—that is assumed to have low value for teachers. This indirect measure, then, requires the assumption to be correct in order for the measure to be meaningful. In a third example, "It is impossible to implement cooperative learning without specialized materials" is labeled as a measure of cost. More directly, this seems to be a measure of perceived physical constraints associated with cooperative learning. The authors seem to assume that if specialized materials are needed, teachers will perceive the innovation as having a high cost. This would not be true in schools where the necessary specialized materials are well-supplied. A number of the 48 items, however, do seem to be well-aligned with the stated construct definitions.

The sample included 933 teachers who provided self-report data regarding level of implementation of the strategy, along with survey data measuring multiple demographic variables and measures of motivation (Abrami, et al., 2004). Surveys were conducted at staff meetings, and collected by a research assistant. Details about the respondents are not included in the published study, so grade level, subject areas, and years of experience, for example, are unknown.

To begin the development of the instrument, the researchers first identified factors included in research instruments measuring teacher implementation of educational innovations (Abrami, et al., 2004). Next, the researchers interviewed CL trainers and researchers about implementation concerns. Lastly, the researchers interviewed 15 teachers about issues affecting a teacher's decision to implement CL. Factors identified through these three steps were then categorized as addressing either expectancy, value, or

cost concerns. The items were then reduced by selecting the concerns or issues that were frequently cited in the literature or in teacher interviews as being related to implementation. The final instrument contained 48 items—11 of which were demographic items. It is not clear from the description of this process whether there were any items found in step one (identifying factors in research instruments) that did not relate to one of the three constructs, since the third step states that only these three constructs were included in the categorization. The measurement scale for the construct-related items was a 5-point Likert scale from strongly agree (1) to strongly disagree (5). The measures were balanced between positively worded and negatively worded items. The implementation measure utilized a five-point Likert scale on which teachers indicated the extent to which they implemented various features of CL, from entirely (1) to not at all (5).

Using stepwise regression on each of the 48 items, the researchers found that teacher expectancy and task value explained 40% of the variance in implementation of cooperative learning (Abrami, et al., 2004). However, given that some appear to be indirect measures of the constructs, further examination is needed. While the report of the results does not provide details on results of each item, the report does state that of the 10 significant predictors, seven of them focused on teacher expectations of CL success, with the largest being, "Cooperative learning would not work with my students." This specific item is aligned well with the definition of expectancy. Of the items measuring perceived value of CL, only two of them were significant. The more significant of those two was "CL is consistent with my teaching philosophy." This again does not appear to be a direct

measure of perceived value. It seems to be reliant on an assumption that if the innovation is consistent with the teacher's philosophy, it will be highly valued. However, this has not been established. Additionally, one significant predictor related to costs was also identified. That item was "Implementing CL takes too much preparation time," which does align with the definition of the construct that was provided.

Overall, the findings of this study are somewhat applicable to the current study. Even though not all items were aligned with the stated construct definitions, the stepwise regression of all 48 items allowed the researchers to identify specific items that appeared to predict CL use. While not all of those items were provided in the report, several examples were provided that were relevant to the current study: 1) The expectancy of whether the innovation would work with the teachers' students, and 2) the perceived cost of preparation time of the innovation. Both of these items have been cited as PBL teacher concerns, and are aligned with the constructs of outcome expectancy and task value. The most significant contribution this study makes to the current study is their extensive review of the literature for the factors related to implementation of innovation, and their in-depth interviews of 15 teachers. The fact that this work led them to focus on factors related to expectancy and value provides strong evidence of the critical role these factors play in the classroom implementation of educational innovations.

Self-efficacy has been studied extensively in relation to teaching practices. In 2009, for example, Tschannen-Moran and McMaster conducted a quasi-experimental study of four different professional development programs to identify sources of self-efficacy in relation to a new teaching strategy for reading and the relationship between

self-efficacy and implementation of the strategy. In this study of 93 primary teachers from nine different schools, the researchers found positive relationships between post-professional development self-efficacy ratings and levels of eventual implementation of the teaching strategy.

The purpose of their study was to determine the role of various sources of self-efficacy in increasing self-efficacy and facilitating the implementation of a new instructional strategy (Tschannen-Moran & McMaster, 2009). In this case, the instructional strategy was a reading strategy for use with struggling, elementary-age readers. This study is relevant to the current study because of the shared examination of self-efficacy in relation to implementation of a new instructional strategy.

The intervention in this study was professional development. Four different professional development treatments were developed with an additive approach according to the three different sources of self-efficacy identified by Bandura: verbal persuasion, vicarious experiences, and mastery experiences (Tschannen-Moran & McMaster, 2009). Treatment one was a three-hour workshop that included verbal persuasion only (lecture, information). Treatment two was a three-hour workshop that included verbal persuasion and vicarious experiences (modeling, demonstration). Treatment three was a 4.5-hour workshop that included all three sources of self-efficacy: verbal persuasion, vicarious experience, and mastery experience (1.5 hours of group practice). Treatment four was the same as treatment three, with the addition of follow-up coaching.

The sample for this study was comprised of 93 K-2 teachers from nine schools (Tschannen-Moran & McMaster, 2009). To avoid the potential for self-selection bias, only schools that were willing to include all K-2 teachers were included in the study. Teachers were randomly placed into one of the four treatment groups. Three measures were employed before and after the intervention: a general teaching self-efficacy measure, a literacy-specific self-efficacy measure, and an implementation measure. The pre-measure was conducted at the beginning of the first workshop, while the post-measure was implemented one month after the workshop. Teachers who indicated (on the pre-measure) significant experience implementing the strategy were eliminated from the study. The Teachers' Sense of Efficacy Scale (TSES) was comprised of 12 items with a 9-point scale from "none at all" to "a great deal." The alpha coefficient on the pre-and post-measure was .90. The Sense of Efficacy for Literacy Instruction (SELI) (adapted) was comprised of 7 items with the same scale as the TSES. The alpha coefficient for the pre-measure was .91 and the alpha coefficient for the post-measure was .88. The implementation pre-measure contained one item and the implementation post-measure contained six items. The alpha coefficient was .99. Examples of the implementation items included "To what extent do you use the Tucker Reading Strategies?" and "To what extent do you use the Tucker hand cues to help your students figure out unknown words when they are reading?"

The results showed that treatment four (all three sources of self-efficacy plus coaching) had the strongest effect on self-efficacy beliefs for reading instruction as well as implementation of the new strategy. An ANOVA revealed that when controlling for

initial SE, 40% of the variance in implementation could be explained by treatment format [$F(3,89) = 19.57$, $p < .01$]. A repeated measures ANOVA did not reveal any significant treatment effect over time for teaching self-efficacy [$F(3,89) = 33.42$, $p < .01$] or for reading instruction self-efficacy [$F(3,89) = 19.69$, $p < .01$].

Based on these results, Tschannen-Moran and McMaster concluded that while the level of self-efficacy at the post measure did play a role in implementation, influencing self-efficacy was not straightforward (2009). Neither the amount of contact time nor the type of treatment had an effect on self-efficacy—with the exception of treatment four, which did have an effect on both self-efficacy and implementation of the strategy. The self-efficacy measures over time did not follow the expected pattern; rather than seeing a consistent increase in self-efficacy, the measures showed unexpected dips and gains. It was theorized that this was because self-assessments can be distorted before one has actual experience in the target skill area. The results suggest that the most powerful learning intervention for new strategy implementation is an authentic, task-specific mastery experience with individualized verbal persuasion. One limitation of this study is that the treatments developed for this study were limited in that contact time ranged from three hours to 5.75 hours. It may not be reasonable to expect change in beliefs about one's capabilities to change in that limited amount of time. Additionally, the self-efficacy measure used was related to reading instruction in general, rather than in the specific strategy that was being implemented. Since self-efficacy is context-specific, this may not have been a meaningful measure in regards to the specific reading strategy.

This study highlighted the complexities of measuring self-efficacy, interpreting the data, and identifying factors that influence this construct. Because self-efficacy beliefs come from perceptions of self and external factors, they may not be meaningful before the individual has had an opportunity to experience the target task in the target environment. During the experience of the target task in the target environment, self-efficacy beliefs may change as the individual experiences the actual environment and can gauge challenges more realistically. Simultaneously, if the individual experiences success, self-efficacy is likely to go up, while experiences of failure may cause a drop in self-efficacy. An additional limitation of the self-efficacy measure is lack of information about why the self-efficacy is low. Because self-efficacy comes from knowledge about how to do the task, perceptions of self, and perceptions of environment, we do not know the specific source of these participants' self-efficacy. It would be helpful to analyze the measurements along with a measure of knowledge of the task and perceptions of school conditions.

School Conditions and Implementation

As Ford (1992) noted, motivational processes result not only from personal goals, beliefs about self, and emotional arousal, but also from beliefs about the individual's context. This notion is also supported by Fullan (2001), who posits that sense of efficacy is shaped by the environment. Theoretically, these claims are supported by social cognitive theory, which positions people as simultaneously object and agent, with personal factors and behaviors interacting with the environment, influencing each other through a reciprocal process (Bandura, 1997). Empirically, the reciprocal relationship

between self and context is well-supported by research conducted by leading school change researchers, such as Hall and Hord (2001), who have found that features such as facilities, resources, policies, structures, and schedules play a significant role in shaping change and Fullan (2001) who has noted the importance of support from professionals, administration, and society. In order to examine how perceptions of school conditions impact the implementation of PBL, it is important to first understand what school conditions teachers find important to support their work. Several studies that investigated this question are reviewed here.

A mixed methods study was designed to gain insight into this and other important questions about new PBL teachers' implementation (Bradley-Levine, et al., 2010). The study involved a survey of 250 educators from a mid-western state who attended a three-day PBL summer institute, on-site observations, focus groups, interviews, and document reviews at one of the schools that had participated in the institute, and journal reflections of institute attendees who took a follow-up graduate-level PBL graduate course at a nearby university. Eighty-nine completed surveys were returned. Five graduate course students submitted four reflective journals each. The specific research questions of interest examined how teachers were implementing or not implementing PBL, the level of support teachers perceived from all stakeholders in the PBL implementation process, and the challenges of implementing PBL. This review focuses only on the second research question, regarding level of support.

Participants in this study included middle and high school administrators and teachers as well as some college and university educators (Bradley-Levine, et al., 2010).

The school that was selected for observations and interviews was a high school with approximately 275 teachers and 4,000 students. This school was considered by the researchers to be exemplary in terms of support for teachers. A teacher-led school transformation process had been in place for three years, focusing on literacy, PBL, deep implementation of professional development, and advisory homeroom. Because of this, and the fact that the school was part of a district-wide PBL initiative, some organizational supports for PBL were in already in place at the time of this study. A PBL professional learning community (PLC) was one of three such communities that had been established at the school. Approximately one third of the teaching staff (95) participated in the PBL PLC. Six of the PBL community participants became PBL teacher leaders and received training in this role from an outside consultant. A PBL instructional coach, who was involved at the district level, was also supporting the school. Weekly time for PLC meetings was allocated for the teacher leaders, the instructional coach, and members of the PLC. The authors noted that the school did not have block scheduling or any other alternative scheduling in place, and that only a few courses were integrated—two structural changes that they believe would better facilitate the PBL implementation process. The literature does provide evidence of the benefits of block scheduling, as it can accommodate the lengthier time needed for group work, discussions, reflection, and other PBL learning processes (Marx, et al., 1997). The literature also illustrates the benefits gained from collaborative planning for PBL (Toolin, 2004).

The qualitative data collected both at the school and in the graduate class were valuable in identifying school conditions that teachers report as important (Bradley-

Levine, et al., 2010). Overall, teachers reported that administrator involvement in creating support structures conducive to successful PBL implementation was very important to them. One of the teacher leaders at the school with adequate support structures in place specifically noted the benefits of their ample technology, availability of coaches, supportive administration, supportive teacher leaders, and time to plan. Participants who did not have adequate support structures in place at their schools acknowledged the value of PBL, but felt that the pedagogy demanded "more than humanly possible," given constraints of time, facilities, budgets, schedules, and accountability (p. 20).

In regards to the planning time, one teacher stated, "I can't think of what we need more" (Bradley-Levine, et al., 2010, p. 15). Of the 89 survey respondents, 19 of them indicated on an open-ended response item that they did not have enough time to plan, implement, and learn PBL. Teachers within schools with inadequate planning time highlighted this as a significant problem. In the schools that did not have adequate support for PBL, teachers indicated that their schools did not accept any variance from standards-based instruction and assessment, which posed a major barrier.

Study participants also identified time for collaboration as an essential ingredient to successful PBL implementation (Bradley-Levine, et al., 2010). The teacher leaders in the school that had collaboration time in place met several times during the year to work together on developing PBL projects, work through implementation issues, and plan for PLC sessions. One teacher described the benefits of having multiple PBL experts to turn to, noting, "When you are the only one, you can feel really overwhelmed" (p. 16). One teacher at the school felt that having everyone in the school "in this giant conversation"

allowed them to implement and learn at a more accelerated rate than would be possible if the learning opportunities were only coming from outside the school (p. 17). Further, this teacher recognized the presence and value of a "collective vision" at the school (p. 17). Professional development was also identified as a critical component. Grassroots professional development developed by the school faculty was thought to be ideal.

Critical friends were also identified as being essential (Bradley-Levine, et al., 2010). One teacher in the graduate course shared how helpful university faculty had been through the design and implementation of her PBL unit, and how helpful it would have been to have a "critical friend" at her school who was also working on PBL (p. 16). The university faculty members served as consultants and were not on-site at the school on a regular basis.

Teachers in the graduate course expressed a need for administrators to be part of the process, and to understand PBL. They also expressed a desire for administrators to educate parents and community members.

In another study, a national survey of almost 1600 teachers using PBL or similar inquiry approaches was conducted to learn about the teachers, their practices, and the school environment (Ravitz, 2010). Individual teachers were pulled from existing Buck Institute for Education customer databases and from partner schools relying on PBL as core to their reform efforts. The schools were part of networks such as High Tech High, New Tech Network, Edvision, and North Carolina New Schools Project. The study revealed findings such as teaching practices employed, reasons teachers were using PBL, challenges, trends in frequency of PBL use, sources of project ideas, and school

conditions that were related to PBL use. PBL use was determined by survey items linked to the PBL learning processes. These items were derived from a national survey conducted by the American Institute for Research and SRI International (2005). Researchers worked with the authors of that survey to identify items that were related to project based or inquiry-based learning.

These items asked what kinds of projects students had completed (such as a creating products, constructing a model, or creating a museum-type exhibit for others); how often students participated in activities such as solving real world problems, evaluating and defending ideas, and orally presenting work to peers, staff, parents, or others; how often the teacher had measured student performance using portfolios, group projects, or similar demonstrations of learning. The study found the following school conditions to have a significant positive correlation with PBL use: Presence of 21st century skills, block or flexible scheduling, team teaching, school-wide rubrics for assessing student work, online teaching and learning strategies, teacher involvement in school leadership or decision-making, and instructional coaching or critical friends visits. The author concluded that classroom practices associated with PBL require support from coaches and a supportive environment for teachers.

The two studies described above provide a picture of school conditions that are conducive to PBL use. The literature on how such conditions relate to teacher motivation to implement PBL is quite limited. However, one study of teachers in Hong Kong did examine relationships among school conditions, attitude for future persistence, and teacher motivation specifically in relation to PBL (Lam, et al., 2010). The authors

identified school conditions relevant to PBL implementation and categorized them as relating to either competence support, autonomy support, or collegial support. These categories were derived from Deci and Ryan's self-determination theory, which holds that higher levels of self-determination result in higher levels of motivation.

The participants were 182 Chinese teachers from eight secondary schools in Hong Kong who were new to PBL (Lam, et al., 2010). Some of the teachers were required by their schools to implement PBL, while others did so on a voluntary basis. Participants completed the survey anonymously within two weeks after their initial projects were complete. The results showed that when teachers perceived their school as being stronger in collegiality and more supportive of their competence and autonomy, they had a higher degree of self-determination in implementation.

The measures used a 6-point Likert-scale from strongly disagree (1) to strongly agree (6) (Lam, et al., 2010). The perceived school support measure had 15 items and one sub-scale for each of the three components of self-determination theory: competence support, autonomy support, and collegial support (derived from self-determination theory). The items covered the following school conditions: clear guidelines on how to guide students, sufficient training on implementation, a reasonable time table for implementation, the school took the workload into account, coordination among stakeholders, involvement in formulating PBL content processes, teachers' opinions were included in the process, voluntary participation in PBL, freedom on how to supervise students, opinions were respected, received encouragement from colleagues when

difficulties were encountered, colleagues shared resources and experiences, colleagues cared about my difficulties, made a concerted effort to implement PBL.

The attitude for future persistence measure contained two items designed to determine willingness to continue with PBL (Lam, et al., 2010). One of the items was "Having considered the time I have spent and the stress I have experienced, I am still willing to support my school in implementing project based learning."

The teacher motivation inventory was composed of 20 items designed to determine level of self-determination by identifying sources of motivation. Four subscales were utilized: external regulation, introjected regulation, identified regulation, and intrinsic motivation. Sample external regulation items included "I participated because it was the duty assigned by my school." Sample introjected regulation items included "I participated because I would feel uncomfortable if I refused to get involved." Sample identified regulation items include "I participated because it is an important teaching strategy." Sample intrinsic motivation items included "I participated because I'm interested in it." Given the nature of the items on the scale, it would have been more appropriate to label this scale as self-determination.

Using structural equation modeling for analyses, the results showed a statistically significant path between perceived school support and self-determination (which the authors are referring to as motivation) ($\beta = .71$, $p < .001$). It is not surprising that perceived school support of self-determination would result in higher levels of self-determination. They also found that the path between self-determination (which the authors are referring to as motivation) and attitude for future persistence to be statistically

significant ($\beta = .60$, $p < .001$). It would be fair to translate this to mean that higher levels of self-determination were related to higher levels of motivation to persist with PBL. The direct path between perceived school support and teacher persistence was also statistically significant ($\beta = .39$, $p < .001$). However the relationship shown here was not as strong as the others. The authors found a statistically significant mediation effect ($z = 5.75$, $p < .001$). Overall, the results indicated that perceived school support had both direct and indirect effects on teacher willingness to continue with PBL. Based on the findings, the authors concluded that teacher motivation is predicated by autonomy support, competence support, and collegial support.

The authors acknowledged heavy reliance on self-report data as the primary weakness of the study. They reflected on the potential for using behavioral measures of teachers' choice, but recognized that implementation is not representative of motivation when implementation is mandated by school policy or administrator influence. This is an important point for consideration when measuring implementation.

A fourth study that provides some insight into PBL-supportive school conditions (which was a pilot of the current study) featured two separate measures of new PBL teachers' motivational beliefs, and PBL goals and activities, and concerns (English, 2011). The teachers were from elementary, middle, and high schools in a mid-western state that recently received private grants to support PBL as part of their reform efforts. The first survey was distributed online to 200 participants at the conclusion of a summer PBL workshop. One-hundred, fifty-four responses were received. Of those, 105 were teachers. Only teacher responses were included in the analysis. This survey included an

open-ended question asking respondents to describe their primary concern (if any) about teaching with PBL.

A total of 93 concerns were received and categorized by topic. Topics were generated based on an interpretation of the main idea of the concern. Concerns determined to be unclear in meaning or irrelevant to the question (11) were eliminated from the analysis. The remaining 82 concerns were categorized into 28 topic categories. Those topic categories that included four or more responses, in order of frequency, are: classroom time (14), how to plan (13), student ability or motivation (12), feeling unprepared (9), lack of certainty of whether PBL can prepare students for state standardized tests (5), and resources and facilities (4).

The second survey was distributed to respondents of the first survey who provided their email addresses and permission to send the follow-up survey (N = 84). The follow-up survey was distributed in November of the first semester after the summer PBL workshop. Fourteen responses were received. This survey included an open-ended question asking respondents to describe factors that either hindered or facilitated their PBL implementation. From the fourteen surveys that were completed, a total of 20 unique comments were submitted in response to this question. Only one response addressed "factors that facilitated PBL implementation." That individual reported that teacher communication and collaboration were factors that facilitated implementation. The factors identified as having hindered PBL implementation were quite similar to the concerns reported at the end of the workshop. The two most frequently reported hindering factors were lack of planning time (6) and student motivation and commitment

(6). Classroom time, challenges in changing teaching style, lack of collaboration, and lack of resources were other hindering factors identified. Each of these factors was reported two times. Applying logic, it is possible to map the reported concerns, hindering factors from this study to facilitating factors with corresponding school conditions identified as important in the other three studies reviewed in this section (with the addition of school wide support for development of student self-regulation skills and a flexible curriculum). This mapping is shown in Table 2. A consolidated list of school conditions highlighted in the four studies reviewed above is provided in Table 3.

Table 2

Mapping of Concerns and Other Factors with School Conditions

Concerns, facilitating factors, hindering factors	Corresponding school conditions
Concern: Classroom time	Block or other alternative scheduling
Concern: How to plan	Professional development
Concern: Student ability or motivation	School wide support for development of student self-regulation skills and professional development
Concern: Feeling unprepared	Professional development
Concern: Lack of certainty of whether PBL can prepare students for state standardized tests	Flexible curriculum and professional development
Concern: Resources and facilities	Adequate technology and facilities
Facilitating factor: Teacher	Collaborative environment

communication and collaboration	
Hindering factor: Lack of planning time	Scheduled planning time
Hindering factor: Lack of resources	Technology and classroom facilities
Hindering factor: Student motivation and commitment	Schoolwide support for development of student self-regulated learning skills, professional development
Hindering factor: Classroom time	Block or alternative schedule
Hindering factor: Challenges in changing teaching style	Professional development
Hindering factor: Lack of collaboration	Collaborative environment

Table 3

Consolidated List of School Conditions Identified in PBL Studies Reviewed

	Bradley-Levine, et al. (2010)	Ravitz (2008)	Lam, et al. (2010)	English (2011)
Block or other alternative scheduling		X		X
Collaborative environment (including team or interdisciplinary teaching, supportive teacher leaders / care and encouragement / sharing, critical friend visits / coordination among stakeholders / communication / shared vision / school-wide rubrics for assessing student work, school wide support for development of student self-regulation skills)	X	X	X	X

Professional development and guidelines	X		X	X
Teacher involvement in school leadership or decision-making, freedom and choice, voluntary implementation, flexible adaptation, flexible curriculum	X	X	X	
Instructional coaching	X	X		
Supportive administration / opinions respected	X		X	
Time to plan	X			
Reasonable timetable for implementation / the school took the workload into account			X	

Summary

In this section, four studies involving the investigation of school conditions and information that informs school conditions were reviewed in this section. Three of the studies reported descriptive data regarding school conditions and teacher perceptions. The fourth study examined school conditions as they related to perceived autonomy support and teacher commitment to implement PBL. Findings from these studies are helpful in shaping future research on this topic.

Research evidence suggests that PBL has high potential to engage students, promote academic achievement, and facilitate their acquisition of the 21st century skills that are becoming more and more critical in today's technology and information-based society. As such, many schools are adopting PBL as a core part of their reform efforts.

However, PBL is a complex teaching method that is not part of mainstream schooling and relies on practices of planning, classroom management, and assessment that are unfamiliar to many. Therefore, sustained change to PBL may be quite challenging for many educators. Based on research of the integration of other educational innovations, it seems that teacher motivational beliefs and perceptions of school conditions are central to teachers' willingness and ability to commit to PBL implementation.

Three motivational beliefs that are pertinent to PBL implementation are task value, outcome expectancy, and self-efficacy. The intrinsic interest, perceived utility, and perceived personal costs aspects of task value are important in a teachers' decision to commit their time and energy toward pedagogy with a steep learning curve and additional effort. According to Fullan (2001), these are key criteria in teachers' decision-making process regarding change and implementation. Those teachers who are more interested in PBL, see its value, and see the potential gains as greater than the potential costs will be more likely to commit to PBL. Outcome expectancy is an important variable, as some teachers are concerned that student achievement on standardized tests may suffer as they learn with PBL. As Fullan's research has shown, one of teachers' primary motivators is engaging and helping students. Teachers with higher outcome expectancy in regard to the ability of PBL to engage and help students, therefore, are more likely to commit to PBL. Last, self-efficacy is important because it is associated with openness to new ideas and to persistence through challenges. This claim is supported by the work of Fullan and other researchers.

There seems to be consensus among theorists and researchers that there is a dynamic interplay between motivational beliefs and school conditions. School conditions that have been identified as important to PBL teachers include block or flexible scheduling, collaborative environment, professional development and guidelines, teacher involvement in school leadership or decision-making, instructional coaching, supportive administration, time to plan, and reasonable timetable for implementation. The literature on the relationship between these school conditions, motivational beliefs, and PBL is quite limited. Therefore, it is suggested in the current study that these three motivational beliefs, for new PBL teachers, are related to school conditions identified as important to PBL implementation, as well as the teachers' PBL implementation.

The specific research questions to be addressed by this study are:

1. How do newly prepared PBL teachers in New Tech Network schools compare with those in non-New Tech Network schools in self-efficacy, outcome expectancy, task value, perceptions of school conditions, and extent of PBL implementation?
2. What is the role of newly prepared PBL teachers' motivational beliefs, perceptions of school conditions, and PBL experience in the extent of PBL implementation?
3. How do newly prepared teachers' motivational beliefs, perceptions of school conditions, and intention to implement PBL reported immediately after PBL training compare with their motivational beliefs, perceptions of school conditions and extent of implementation during the first two months of school following the PBL training?

4. What do newly prepared PBL teachers report as factors that impacted implementation and motivation during their first two months of implementation efforts?

3. Methods

This study was based on three primary assumptions about motivational beliefs, perceptions of school conditions, and implementation of PBL: 1) Teachers' motivational beliefs and perceptions of the environment are important drivers in their decision to adopt PBL as a primary pedagogical approach in the classroom; 2) Teachers' motivational beliefs and perceptions of school conditions are interrelated; 3) Teachers' motivational beliefs and perceptions of the school environment change over time as they gain experience with PBL in the classroom. With these assumptions, this study sought to identify relationships of the specified variables, and how measures of these variables change between an introductory PBL workshop held during the summer, and the first school semester after the workshop. A number of small case studies have been conducted to learn about teachers' thoughts and perceptions about implementation of PBL and other learner-centered approaches during the initial stages of implementation (Ladewski, et al., 1994; Pederson & Liu, 2003; Toolin, 2004). These studies have provided essential knowledge about the central phenomena, and they have provided justification for the research problem (Creswell, 2008). However, such studies have been limited in providing knowledge about patterns of implementation across contexts, and over time, particularly as they relate to motivational beliefs and perceptions of school support for PBL. The current study leverages findings from earlier case studies and smaller survey studies to identify such patterns. To accomplish this research goal, a survey study was conducted,

relying primarily on correlational analyses to provide a general picture of the research problem, and supplementing with qualitative data (Creswell, 2008). This approach was informed by the embedded research design (Clark & Creswell, 2006). In this case, quantitative data were used to answer research questions one through three. Qualitative data (responses to open-ended questions) were used to answer research question four. Qualitative data (interviews and responses to open-ended survey questions) were utilized to explain the findings for each of the four research questions.

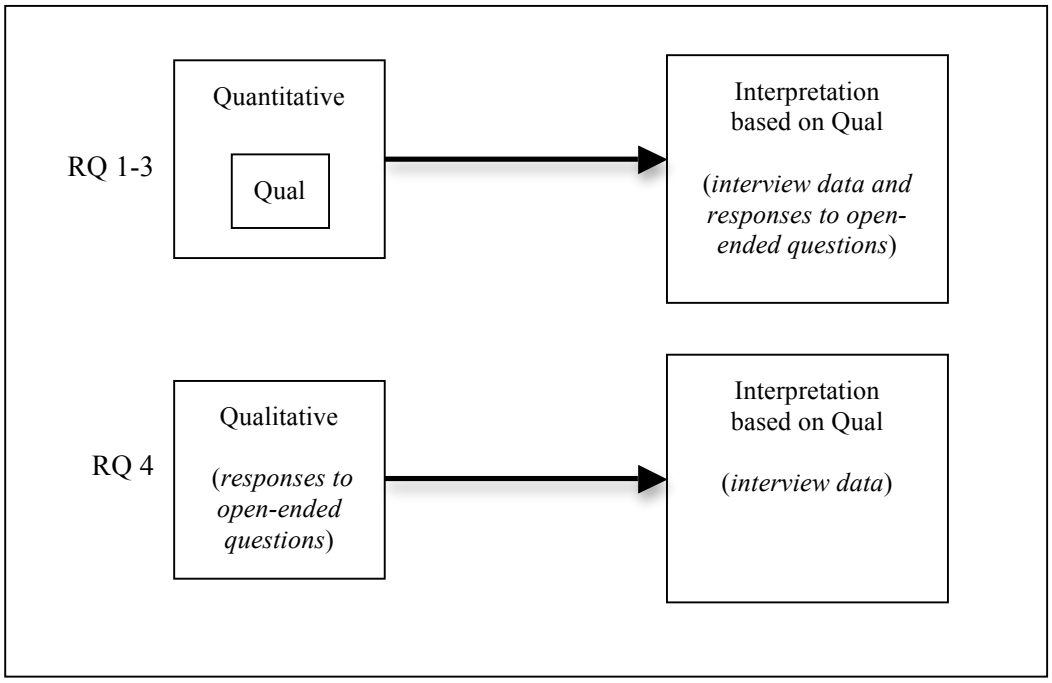


Figure 1. Research design.

Correlational designs allow the researcher to measure the relationship between two or more variables and determine whether one can predict another (Creswell, 2008). The variables of focus in this study, including the three motivational beliefs (self-

efficacy, outcome expectancy, task value), perceptions of two types of school conditions (teacher participation and school structures), and extent of PBL implementation were measured with self-report data provided by teacher participants. Validation of these data were done through a survey of the teachers' matched PBL coaches, when available. Additionally, telephone interviews provided a limited degree of validation that teachers were in fact implementing PBL, as defined in this study. Question types included multiple-choice, rating on a scale from 0 – 100, and open-ended. The open-ended questions were designed to allow participants to express their experiences without constraints that may be imposed by multiple-choice questions (Creswell, 2008). The qualitative data generated from these questions will be applied to enhance understanding of the "why" behind individual responses and response trends.

Self-report data are effective in measuring an individual's attitudes, feelings, and perceptions (Creswell, 2008). The validity of self-report data for teachers' implementation of their own classroom practices, however, has been challenged (Ross, McDougall, Hogaboam-Gray, & LeSage, 2003). Several reasons have been given for why teacher self-reports on implementation may be inaccurate: 1) some aspects of practice cannot be easily measured because they are not directly observable; 2) survey items may be understood differently than intended; 3) teachers may report their intentions, rather than actual behaviors; 4) teachers may have distorted self-perceptions (Ross, et al., 2003). Attempts to validate teachers' self-report data of implementation have had mixed results. Researchers have analyzed matched data from students, trained observers, and analysis of student artifacts to determine correlations. In some cases, the

correlations were strong, while in other cases, the two data sets were only weakly correlated (Ross, et al., 2003). Other means of measuring implementation include direct observation of classroom activities, analysis of student products, and interviews. Given the scale of the current study, direct observation and analysis of student products were not feasible. Obtaining a valid measure of PBL implementation is of high importance. The validity of the self-report data will be strengthened in the current study by having teachers indicate the frequency of specific activities that indicate PBL usage. Additionally, observations of implementation from matched PBL coaches and teacher leaders were also obtained through a survey. Further, a limited number of interviews were conducted to obtain explanatory data as well as a limited degree of validation for PBL implementation. It is important to note that this study is only concerned with the extent to which the program components were implemented (Scheirer & Rezmovic, 1983), rather than the quality or fidelity of implementation, which are primary concerns of many studies focused on the effect of an intervention (O'Donnell, 2008).

To obtain a satisfactory sample size, and to reduce the potential for response bias, an approach outlined by Dillman (2006) was utilized. This approach involved multiple communications and use of social and economic incentives. All teachers who completed Survey 1 were entered into a drawing to win an iPad. All teaches who completed Survey 2 were entered into the drawing a second time, and received a $10 Amazon.com gift card via email.

Participants

The primary study participants were elementary, middle, and high school teachers who participated in the four PBL professional development conferences—described above—held in the summer of 2012. Secondary participants were PBL coaches and lead teachers nominated by the teachers to provide observational data for validation purposes. Two of the conferences were provided by New Tech Network (NT) for teachers from their member schools, while the other two conferences were provided by university-affiliated organizations providing PBL training, coaching, and research (Non-NT). These conferences were selected as data collection sites because they were designed specifically for educators with little-to-no experience with PBL and the conference providers were supportive of data collection. Approximately 151 schools were represented. A precise number is not available due to the occurrence of acronyms and abbreviated school names in the self-report data. Teachers were from schools in urban, suburban, and rural areas throughout the U.S. A significant portion of the non-NT teachers was from one state in the mid-West.

Most of the NT conference teacher attendees (600) were new to the NT organization and to PBL, and were directed to attend one of the two summer conferences. The non-New Tech teacher *and* administrator attendees (400) were new to PBL and attended either for personal interest, or in response to their school administration's direction or encouragement. The survey was distributed to all attendees, including those who were not teachers. Survey instructions specified that the survey was designed for teachers only.

Because school culture and school environment have been found to play a significant role in teacher motivation and classroom practices (Ford, 1992; Fullan, 2001; Hall & Hord, 2001; Lam, et al., 2010; Lepper & Hodell, 1989), it is important to note the characteristics of the culture and environment in NT schools. NT is a whole school reform model with PBL as its core instructional practice. School leadership practices, schedules, facilities, computers and other equipment in these schools are designed specifically to support PBL. NT provides four and a half years of support to their partner schools, including school planning, principal training, and personalized coaching, for example (New Tech Network, 2012). When a teacher accepts a job at a NT school, he or she is agreeing to teach with PBL on a full-time basis. NT specifies certain conditions that the district must meet in order to start a NT school, including: small school size of 400 – 500 students; professional climate based on trust, respect, and responsibility; a computer and school-wide Internet access for all students; a flexible schedule that supports team teaching and cross-curricular projects; all courses taught with PBL as the primary method of instruction; and creation of physical learning spaces that support team teaching and student collaboration. The non-NT teachers who participated in this study may or may not have these affordances in their schools. Because of these potential differences, the responses from these two populations were analyzed separately in most instances.

Survey 1 resulted in 343 responses, for a response rate of 34%. Of the 343 participants who responded to Survey 1, 186 responded to Survey 2, for a response rate of 54%. Survey 1 data were comprised of 180 non-NT teachers (52%) and 163 NT

teachers (48%). Survey 2 data were comprised of 97 non-NT teachers (52%) and 89 NT teachers (48%).

Non-NT teachers. Of the non-NT teachers, 75 (42%) were from elementary schools, 43 (24%) were from middle schools, and 62 (34%) were from high schools. Ninety-three (52%) of these teachers indicated that their highest degree was a bachelor's degree, while 82 (46%) hold a master's degree, and five (3%) had a terminal degree (e.g. Ph.D. or Ed.D.). One hundred sixty-six (92%) were teachers of academic subjects, six (3%) were teachers of physical education, art, or music, and eight (5%) were special education teachers. These teachers' years of teaching experience ranged from less than a year (15, 8%) to more than 30 years (7, 4%). The majority of them, however, had a range of teaching experience from 6 to 20 years (80, 44%). In response to a question about the primary reason they were planning to teach with PBL, 38 of them (21%) indicated that they were doing so because their school required or expected them to, while 131 (73%) were doing so to join colleagues already teaching with PBL, to help students, or for enjoyment or career reasons.

The most frequently reported reason non-NT teachers gave for planning to teach with PBL was to help their students (107, 60%). Most of these teachers reported their level of experience in teaching with PBL as "beginner" (135, 75%), while 32 of them (18%) reported being at the "intermediate" level, and 13 (7%) reported being at the "advanced" level. Most of these teachers also reported having little-to-no experience as a learner in PBL (130, 72%). Additionally, 163 of them (91%) indicated that they had little-to-no instruction, or only basic information about PBL or other inquiry-based

methods in their pre-service programs. Only 17 (9%) reported having in-depth study about PBL during pre-service. Forty-one (23%) non-NT teachers indicated that their learning preference was "instructor-directed," while 98 (54%) of them prefer to learn through "self-directed or collaborative" means. Forty-one (23%) of them were "neutral or not sure" about their preferred way to learn.

NT teachers. Of the 163 NT teachers, 16 (10%) were from elementary schools, 27 (17%) were from middle schools, and 120 (73%) were from high schools. Most of them (88, 54%) reported master's degree as their highest degree, while 72 (44%) had a bachelor's degree, and 3 (less than 2%) had a terminal degree. Most of the NT teachers teach core academic subjects (N = 150, 92%), while 9 (6%) of them teach art, music, or physical education, and 4 (3%) of them are special education teachers. Their years of experience as teachers ranged from less than a year (18, 11%) to more than 30 years (6, 3.7%). Most of them reported 1-20 years of experience (126, 77%). Even though New Tech schools require teachers to teach using PBL, only 74 (46%) of these teachers indicated school requirement or expectation as their primary reason for planning to teach with PBL. Fifty-eight of them (36%) selected "to help students," and 22 (14%) of them selected either "to join colleagues," or "for enjoyment or career" as their primary reason. One hundred (61%) of the NT teachers identified themselves as beginners in PBL teaching, while 45 (26%) identified themselves as being at the intermediate level, and 21 (13%) identified themselves as being at the advanced/leader level. Ninety-seven (60%) of these teachers reported having little-to-no experience learning through PBL, 51 (31%) reported having moderate experience learning through PBL, and 15 (9%) reported having

extensive experience learning through PBL. A significant majority (165, 95%) of NT teachers indicated "none or almost none" or "some basic information" as the level of instruction they received about PBL and other inquiry-based methods during their pre-service programs. Only 8 (5%) reported having extensive instruction about PBL or other inquiry-based methods in pre-service. Most (103, 63%) of the NT teachers indicated "self-directed or collaborative" as their preferred method for learning, while 34 (20%) indicated "instructor-directed," and 26 (16%) were neutral or not sure about their learning preference. Reported frequencies of key demographic variables for NT and non-NT teachers are shown in Table 4. The most notable differences between the frequency percentages between the two groups on demographic variables were on school level and reason for PBL. While the large majority of NT's teachers were from high schools (73%), the non-NT sample was more evenly distributed. Of the non-NT teachers, 19% reported "school requires it" as the primary reason for planning to teach with PBL, which is substantially less than NT teachers who indicated this as their primary reason for planning to teach with PBL (43%).

Table 4

Demographic Data Comparison: NT and non-NT (Survey 1)

	Non-NT (N = 180)	NT (N = 163)
School Level (rounded %)		
• Elementary	42	10
• Middle	24	17
• High School	34	73
Degrees (rounded %)		
• Bachelor's	52	44

• Master's	46	54
• Terminal	3	2
Subject (rounded %)		
• All (Elementary)	33	11
• English/Language Arts	16	20
• Math	9	15
• Science	12	20
• Social Studies	11	18
• Business	5	1
• Technology	5	3
• Foreign Language	2	4
• Art, Music, or Phys. Ed.	3	6
• Special Education	4	2
Yrs. of Teaching Exp. (rounded %)		
• Less than 1 year	8	11
• 1-5 years	29	26
• 6-10 years	17	20
• 11-20 years	28	31
• 21-30 years	14	8
• More than 30 years	4	4
School Location (rounded %)		
• Urban/Urban Fringe	25	29
• Suburban/Small City	31	29
• Rural/Small Town	43	40
• Other	1	2
Reason for PBL (rounded %)		
• School requires it	19	43
• Not required, but expected	2	3
• To join colleagues	5	4
• To help students	60	36
• For enjoyment or career	8	9
• NA/None of the above	6	5
Preferred Way To Learn (rounded %)		
• Instructor-directed	23	21
• Self-directed or collaborative	54	63
• Neutral or not sure	23	16
Extent of Pre-Service PBL Instruction (rounded %)		
• None or almost none	48	48
• Some basic information	42	48
• In-depth study	10	5
PBL Experience (mean z score)	-.39 (SD = 2.95)	.43 (SD = 3.02)

Coaches/lead teachers. Secondary participants were PBL coaches and/or teacher leaders who work with the teacher participants in the study. The coaches, who are sometimes employed by the school or school district, or are brought in on a consulting basis, are PBL experts who typically have experience teaching with PBL in the classroom and experience teaching PBL methods to other teachers. Not all teachers have a PBL coach or a teacher leader. Sixty-three teachers (34%) nominated and provided contact information for a coach or teacher leader. Each of coaches or teacher leaders was invited to report their observations of the PBL implementation activities of the teacher who had nominated him or her. Fifteen of the sixty-three nominated coaches or instructional coaches completed the survey for a response rate of 24%.

Because research questions one and two utilized data from Survey 2 only, and research question three examined differences in measures on Surveys 1 and 2, assessment of validity of the results requires knowledge of characteristics of teachers who participated in Survey 2 (N = 186), as well as those of teachers who didn't participate in Survey 2 (N = 157). An independent samples *t* test was conducted to compare Time 1 means of key variables for those who completed Survey 2 and those who did not. No significant differences were found between the groups on self-efficacy, outcome expectancy, task value, the two perceptions of school conditions variables, PBL experience, or intention to implement (Appendix D and Appendix E). A comparison of the teachers who did and did not complete Survey 2 was also conducted on frequencies for the demographic variables. The results for NT and non-NT teachers are provided in Table 5 and Table 6.

For non-NT teachers (Table 5), the only substantial difference between those who did and did not complete Survey 2 was on academic subject taught. Of those who participated in Survey 1, 12% were science teachers, as compared with 1% on Survey 2.

Table 5

Demographic Data Comparison: Teachers Who Did and Did Not Complete Survey 2 (Non-NT)

	Did Not Complete Survey 2 (N = 83)	Completed Survey 2 (N = 97)
School Level (rounded %)		
• Elementary	37	45
• Middle	31	18
• High School	31	37
Degrees (rounded %)		
• Bachelor's	54	50
• Master's	43	47
• Terminal	3	3
Subject (rounded %)		
• All (Elementary)	31	35
• English/Language Arts	12	20
• Math	11	7
• Science	12	1
• Social Studies	11	10
• Business	6	4
• Technology	6	5
• Foreign Language	3	0
• Art, Music, or Phys. Ed.	5	2
• Special Education	3	5
Yrs. of Teaching Exp. (rounded %)		
• Less than 1 year	8	8
• 1-5 years	33	26
• 6-10 years	16	18
• 11-20 years	25	30
• 21-30 years	16	13
• More than 30 years	2	5
School Location (rounded %)		
• Urban/Urban Fringe	28	23
• Suburban/Small City	36	27
• Rural/Small Town	36	49

• Other	0	1
Reason for PBL (rounded %)		
• School requires it	22	18
• Not required, but expected	3	1
• To join colleagues	5	5
• To help students	60	59
• For enjoyment or career	8	9
• NA/None of the above	2	10
Preferred Way To Learn (rounded %)		
• Instructor-directed	20	25
• Self-directed or collaborative	60	51
• Neutral or not sure	20	24
Extent of Pre-Service PBL Instruction (rounded %)		
• None or almost none	53	44
• Some basic information	40	44
• In-depth study	7	12
PBL Experience (mean z score)	-.89 (2.57)	.05 (3.19)

As shown in Table 6, for most demographic variables, the frequencies for NT teachers who completed Survey 2 were similar to those who did not complete Survey 2. There was a significant change in the frequency percentage for types of school. Of the NT teachers who participated only in Survey 1, 17% were elementary teachers, while only 3% of those who participated in Survey 2 were elementary teachers. The percentage of high schools represented was 7% for those who did not complete Survey 2, and 80% for those who did complete Survey 2. The frequencies of educational degrees also changed significantly. The percentage of teachers with bachelor degrees who did not complete Survey 2 was 56%, while those with the same level of education of those who did complete Survey 2 was 34%. The number of teachers with master's degrees was greater for those who did complete Survey 2.

Table 6

Demographic Data Comparison: Teachers Who Did and Did Not Complete Survey 2 (NT)

	Did Not Complete Survey 2 (N = 75)	Completed Survey 2 (N = 88)
School Type (% rounded)		
• Elementary	17	3
• Middle	16	17
• High School	67	80
Degrees (% rounded)		
• Bachelor's	56	34
• Master's	43	63
• Terminal	1	3
Subject (% rounded)		
• All (Elementary)	17	6
• English/Language Arts	9	15
• Math	16	18
• Science	21	18
• Social Studies	22	15
• Business	3	0
• Technology	4	2
• Foreign Language	3	5
• Art, Music, or Phys. Ed.	5	6
• Special Education	0	4.5
Years of Teaching Experience (% rounded)		
• Less than 1 year	9	12
• 1-5 years	30	24
• 6-10 years	17	22
• 11-20 years	29	33
• 21-30 years	11	6
• More than 30 years	4	3
School Location (% rounded)		
• Urban/Urban Fringe	25	33
• Suburban/Small City	29	29
• Rural/Small Town	45	35
• Other	0	3
Reason for PBL (% rounded)		

• School requires it	47	40
• Not required, but expected	4	1
• To join colleagues	3	6
• To help students	35	36
• For enjoyment or career	6	11
• NA or none of the above	5	6
Preferred Way To Learn (% rounded)		
• Instructor-Directed	24	18
• Self-Directed or Collaborative	54	63
• Neutral or Not Sure	12	19
PBL Experience (Mean z score)	.06 (3.26)	.05 (2.75)

Data Collection Instruments

Personal data questionnaire. The personal data section contains 12 items related to descriptive data about the participants, including information such as years of teaching experience, subject and grade-level taught, reason for attending the conference (required or optional), preferred methods for learning, and level of exposure to and experience with PBL.

PBL self-efficacy beliefs scale (Bandura, 2006). This scale was designed to determine how capable participants believe they are in PBL-specific teaching activities. The scale was constructed using the teaching processes of PBL and Bandura's guide to creating self-efficacy scales (2006). The scale includes nine items. Participants indicated their level of certainty that they can perform PBL-related tasks, given a scale that ranges from 0 ("certain I cannot do") to 100 ("highly certain I can do"). Sample items include: I can develop driving questions that engage my students; I can develop formative assessments to inform how I work with students. Self-reported measurements closer to "Certain I can do this," indicate a higher level of self-efficacy.

The PBL-specific teaching activities that were included on the scale were derived from the materials taught during the PBL conferences where data for this study were collected, and from PBL-related literature. Those activities were centered around core aspects of the PBL methodology, including developing driving questions, developing detailed project plans, teaching students how to manage their own learning, providing learning scaffolds, facilitating students' learning, and assessing student project work.

To test the construct validity, the instrument was reviewed by two educational psychology professors who are well versed in self-efficacy as well as two classroom teachers who have been teaching with PBL for more than one year. The content validators were provided instructions to indicate the level of validity using a 6-point Likert scale measuring how related each item is to the targeted construct, with 0 indicating not at all related and 5 indicating highly related. Further testing of the survey for clarity, user-friendliness, and functionality was conducted by 24 PBL instructors. Instructors completed the survey and entered relevant comments, if any, in a comment box provided on the last page of the survey. Minor changes were implemented based on feedback from both sets of tests.

A factor analysis (using SPSS v19) was conducted to determine construct validity (Table 7). An exploratory factor analysis on the nine items for Time 1 data revealed a single factor with an eigenvalue of 5.94 and accounting for 65.96% of the variance in underlying items. Factor loadings ranged from .74 to .85. In a test of inter-item reliability, a Cronbach's alpha of .93 resulted. The exploratory factor analysis on Time 2 data revealed a single factor with an eigenvalue of 5.89 and accounting for 65.48% of the

variance in underlying items. Factor loadings ranged from .75 to .84. In a test of inter-item reliability, a Cronbach's alpha of .93 resulted.

Table 7

Self-Efficacy Scale Reliability and Principal Component Analysis

	Time 1 (N = 343)	Time 2 (N = 186)
Cronbach's alpha	.93	.93
	Factor Loading	Factor Loading
Component		
1. I can create driving questions.	.76	.75
2. I can create projects that cover the required curriculum at the necessary level of depth.	.78	.76
3. I can organize students into groups that facilitate learning.	.74	.82
4. I can establish appropriate scaffolds to facilitate student acquisition of content knowledge.	.84	.80
5. I can create effective assessments for project work.	.85	.82
6. I can teach students self-regulation skills (such as goal setting, self-monitoring, and reflection).	.83	.84
7. I can effectively manage class time during PBL.	.85	.84
8. I can effectively provide students formative feedback.	.84	.84
9. I can guide students to solve their problems rather than giving them the answers.	.81	.80

PBL outcome expectancy scale (Siwatu, 2007). This scale was designed to determine how strongly participants expect specific positive outcomes to occur as a result of their effective PBL teaching. This measure is based on Bandura's definition of outcome expectancy (1986). The scale is an adapted version of the Culturally Responsive Teaching Outcome Expectancy Scale (Siwatu, 2007). Items are based on the challenges

that PBL presents for students, as reported in previous studies, and teacher reported concerns about student performance. Participants were to indicate a probability that the given behavior would lead to the specified outcome. The scale contains three items on a scale from 0 (entirely uncertain) to 100 (entirely certain). A sample item is: "By learning through PBL, all or most students will meet or exceed their current levels of performance and achievement." Higher ratings indicate a more positive outcome expectancy.

To test the construct validity, the instrument was reviewed by two educational psychology professors who are well versed in the outcome expectancy construct and two classroom teachers who have been teaching with PBL for more than one year. The content validators were provided instructions to indicate the level of validity using a 6-point Likert scale measuring how related each item is to the targeted construct, with 0 indicating not at all related and 5 indicating highly related. Further testing of the survey for clarity, user-friendliness, and functionality was conducted by 24 PBL instructors. Instructors completed the survey and entered relevant comments, if any, in a comment box provided on the last page of the survey. Minor changes were implemented based on feedback from both sets of tests.

An exploratory factor analysis of Time 1 data revealed a single factor with an eigenvalue of 2.45 and accounted for 81.55% of the variance in underlying items. Factor loadings ranged .86 to .93 (Table 8). A Cronbach's alpha of .90 resulted. An exploratory factor analysis of Time 2 data revealed a single factor with an eigenvalue of 2.55 and accounted for 84.84% of the variance in underlying items. Factor loadings were all in the .92 range. In a test of inter-item reliability, a Cronbach's alpha of .91 resulted.

Table 8

PBL Outcome Expectancy Scale Reliability and Principal Component Analysis

	Time 1 (N = 343)	Time 2 (N = 187)
Cronbach's alpha	.90	.91
Component	Factor Loading	Factor Loading
1. Most or all students will meet or exceed their current levels of performance and achievement.	.91	.93
2. Most or all students will learn to manage their own learning.	.93	.93
3. Most or all students will be highly engaged in the learning.	.86	.92

PBL task value scale (Wigfield & Eccles, 1995). This scale was designed to determine the level of value participants place on PBL, and was adapted from the Eccles & Wigfield Task Value scale (1995). The scale measures three components of value: intrinsic interest value, attainment value/importance, and extrinsic utility, as defined by Eccles & Wigfield, 1995. The scale included three items for intrinsic interest value, four items for attainment value/importance, and three items for extrinsic utility value, for a total of ten items. While the Eccles & Wigfield (1995) scale uses a different 7-point Likert scale for each sub-scale, this adapted version utilizes a 100-point scale to be consistent with the other two motivational beliefs scales in this study, making the instrument easier for participants to use, and making data consistent across scales. Participants were to indicate the value they place on PBL by rating each item from 0 to

100. The value labels are different for each item. Sample items include: How much do you like teaching with PBL? (intrinsic interest) Is the amount of effort it will take to teach with PBL worthwhile to you? (attainment value/importance). How useful are the skills that students learn through PBL? (extrinsic utility). Higher ratings indicate a higher level of value placed on PBL.

To test the construct validity, the instrument was reviewed by two educational psychology professors who are well versed in task value as well as two classroom teachers who have been teaching with PBL for more than one year. The content validators were provided instructions to indicate the level of validity using a 6-point Likert scale measuring how related each item is to the targeted construct, with 0 indicating not at all related and 5 indicating highly related. Further testing of the survey for clarity, user-friendliness, and functionality was conducted by 24 PBL instructors. Instructors completed the survey and entered relevant comments, if any, in a comment box provided on the last page of the survey. Minor changes were implemented based on feedback from both sets of tests.

An exploratory factor analysis of the 10 items on Time 1 data revealed two factors. To reduce the scale to one factor, two items were removed: "Will you be recognized by your school colleagues and administration for your efforts to learn and execute PBL?" and "How important is PBL to the achievement of most or all of your students"? On Time 1 data, the exploratory factor analysis on the remaining eight items resulted in an eigenvalue of 5.62 and accounted for 70.26% of the variance in underlying items. Factor loadings ranged from .69 to 93 (Table 9). In a test of inter-item reliability,

a Cronbach's alpha of .93 resulted for the eight items. On Time 2 data, the exploratory factor analysis on the eight items resulted in an eigenvalue of 5.68 and accounted for 70.96% of the variance in underlying items. Factor leadings ranged from .65 to .96. In a test of inter-item reliability, a Cronbach's alpha of .93 resulted for the eight items.

Table 9

Task Value Scale Reliability and Principal Component Analysis

	Time 1 (N = 343)	Time 2 (N = 187)
Cronbach's alpha	.93	.93
Component	Factor Loading	Factor Loading
1. How much will you enjoy teaching with PBL?	.90	.89
2. How rewarding will PBL be for you?	.93	.94
3. How satisfying will PBL be for you?	.93	.96
4. Is the amount of effort it will take for you to teach with PBL worthwhile to you?	.89	.88
5. Is it important to your career to be successful in teaching with PBL?	.74	.82
6. Will you learn new teaching skills by teaching with PBL?	.67	.74
7. How useful are the skills that students learn through PBL?	.87	.82
8. In order to help your school be successful, is it important for you to be successful with PBL in your classroom?	.74	.65

Perceptions of school conditions-teacher participation measure (Ravitz, 2008). This measure asked participants to indicate the extent to which they perceived they would participate in collaborative, decision-making, and professional development activities (on the first survey) and the extent to which they perceive they are participating

(on the second survey) in these areas, which are important to PBL implementation as reported in the literature. This measure is adapted from a national survey on high school reform and PBL (Ravitz, 2008). Participants indicated their perceptions of each condition given. The scale ranged from 1 ("never or almost never") to 4 ("always or almost always"). The scale contains a total of 4 items. A sample item is "Teachers at my school will be (or were) involved in school leadership, setting policies, or making important decisions for the school."

An exploratory factor analysis on the Time 1 data revealed a single factor with an eigenvalue of 2.76 and accounted for 69% of the variance in underlying items. Factor loadings ranged from .82 to .85 (Table 10). A Cronbach's alpha of .85 resulted for 4 items. An exploratory factor analysis on the Time 2 data revealed a single factor with an eigenvalue of 2.61 and accounted for 65.26% of the variance in underlying items. Factor loadings ranged from .79 to .82. A Cronbach's alpha of .82 resulted for 4 items.

Table 10

School Conditions-Teacher Participation Scale Reliability and Principal Component Analysis

	Time 1 (N = 343)	Time 2 (N = 187)
Cronbach's alpha	.85	.82
Component	Factor Loading	Factor Loading
1. Have instructional coaches and/or "critical friends" visits	.82	.79
2. Be involved in school leadership, setting policies or making important decisions for the	.85	.82

school		
3. Participate in high quality professional development experiences	.82	.81
4. Collaborate with colleagues to plan and discuss issues	.83	.81

Perceptions of school conditions-school structures measure (Ravitz, 2008).

This measure asked participants to indicate the extent to which they perceived their school would provide (on the first survey) and the extent to which they did provide (on the second survey) in these areas, which are important to PBL implementation as reported in the literature. This measure is adapted from a national survey on high school reform and PBL (Ravitz, 2008). Participants indicated their perceptions of each condition given. The scale ranged from 1 ("never or almost never") to 4 ("always or almost always"). The scale contains a total of 8 items. Sample items are "A flexible curriculum to accommodate PBL will be (or was) in place at my school," and "Adequate teacher planning time will be (or was) in place at my school."

An exploratory factor analysis on the Time 1 data revealed a single factor with an eigenvalue of 5.42 and accounted for 67.70% of the variance in underlying items Table 11). Factor loadings ranged from .70 to .92 (Table 11). A Cronbach's alpha of .93 resulted for the eight items. An exploratory factor analysis on the Time 2 data revealed a single factor with an eigenvalue of 5.04 and accounted for 63.01% of the variance in underlying items. Factor loadings ranged from .67 to .91. A Cronbach's alpha of .92 resulted for the eight items.

Table 11

School Conditions-School Structures Scale Reliability & Component Analysis

	Time 1 (N = 343)	Time 2 (N = 187)
Cronbach's alpha	.93	.92
Component	Factor Loading	Factor Loading
1. A school-wide emphasis on problem-based, project based, or inquiry learning	.83	.77
2. Block or flexible scheduling or extended periods for working on projects or other activities	.72	.72
3. A flexible curriculum to accommodate PBL	.84	.83
4. School-wide rubrics for assessing student work across different subjects, grades, or courses	.88	.84
5. A grading policy aligned with PBL	.92	.91
6. A collaborative project planning and assessment system	.89	.90
7. Adequate student access to technology	.70	.66
8. Adequate teacher planning time	.77	.67

Intention to implement PBL indicator (English, 2011). This scale is a single item designed to determine the highest level of PBL implementation participants intended for the semester following the PBL institute. Levels of implementation are: "no plans to pursue PBL-related activities" (0), "learning more" (1), "planning a project to be implemented later" (2), "implementing one project" (3), "implementing two or three projects" (4), or "fully adopting PBL as the primary methodology" (5). Higher ratings indicate intention to complete a higher level of PBL implementation.

The extent of PBL implementation measure (English, 2011). On this measure, participants indicated their level of activity on the same continuum of activities from "no PBL-related activities" (0), "learning more" (1), "planned a project to be implemented later" (2), "implemented one project" (3), "implemented two or three projects" (4), or

"fully adopted PBL as the primary methodology" (5). Higher ratings indicate more extensive PBL-related activity.

PBL component implementation measure (Ravitz, 2008). On this measure, participants indicated the extent to which key features of PBL were implemented. Given that most of the teacher participants had little-to-no experience with PBL, and given the complex nature of PBL, it is expected that teachers' practices would develop slowly over time. Therefore, this measure was designed to assess the extent to which PBL components were implemented (Scheirer & Rezmovic, 1983), rather than the quality or fidelity of implementation, which are primary concerns of intervention studies (O'Donnell, 2008). This measure is adapted from a national survey of PBL and high school reform (Ravitz, 2008). The items describe key teaching and learning processes associated with PBL. This measure contains six items addressing teacher activities and 14 items addressing student activities. The answer choices reflect frequency of use on a four-point scale ranging from "never or almost never" (1) to "always or almost always." Sample items include: "This semester, how often did you use rubrics for assessing student work on projects"? and "This semester, how often did most of your students work collaboratively in groups?"

Coaches and instructional leaders nominated by teacher participants were asked to complete the survey about the subject teachers' implementation. These data were collected for validation purposes only.

Qualitative Data

Open-ended questions were included on the second survey. These questions were designed to answer research question four and to understand participants' experiences (Creswell, 2008). These data gave participants an opportunity to generate their own responses, rather than selecting a response from researcher-designed choices. The PBL Follow-up survey contained the following open-ended questions:

1. What factors have hindered or facilitated your PBL efforts so far this semester?
2. What factors have contributed to or lessened your motivation to implement PBL so far this semester?
3. What tools, resources, information, or other support do you need to move forward with your PBL implementation?

Additionally, comment boxes were provided after the *PBL Component Implementation Measure* and after the *Perceptions of PBL School Conditions Measure* (Ravitz, 2008).

Semi-structured interviews were conducted to expand on data reported on the survey. Sample questions included:

1. What is the extent of PBL activity in your school?
2. How has your experience been with PBL so far this semester?
3. What motivates you to use PBL in your teaching?
4. What advice would you give to administrators to get teachers on board with PBL?

Data Collection Procedures

Data were collected through the use of three online surveys (Survey 1 and Survey 2 for teacher participants, and Coach Survey for PBL coaches/lead teachers nominated by the teacher participants), as well as semi-structured telephone interviews with teacher participants. To facilitate data collection, the researcher established research partnerships with providers of four separate PBL professional development conferences. Such conferences were identified as appropriate venues for data collection, since the conferences were designed primarily for teachers new to PBL. Two of the conferences were conducted by New Tech Network, while the other three were conducted by university-affiliated organizations supporting PBL initiatives in K-12 education. The conferences were each three to five days long and provided an introduction to PBL to teachers, administrators, and classroom support personnel such as instructional technology specialists and classroom aides. During the conferences, teachers participated in workshops and forums on various aspects of teaching with PBL, such as creating project plans, facilitating learning, using technology, configuring student groups, and creating rubrics.

Data were collected at two different times. Time 1 took place during the conferences, using Survey 1 (Appendix G). Survey 1 contained personal data items, the PBL Self-efficacy Scale, the PBL Outcome Expectancy Scale, the PBL Task Value Scale, the PBL Intention to Implement Indicator, the Perceptions of school conditions-Teacher Participation) Measure and the Perceptions of School Conditions-School Structures) Measure, as well as an item to nominate a PBL coach or lead teacher to

provide observational data, and an item to indicate willingness to participate in a follow-up survey. The survey was distributed during each of the four conferences. Representatives from the conference providers sent their attendees a link to Survey 1 via email, along with encouragement to participate, and an informational flyer (Appendix F) created by the researcher. The informational flyer explained the purpose of the study and the incentives, which included an entry into an iPad drawing (one entry for each completed survey) and an Amazon.com gift card (for the second survey only).

Time 2 took place during early November, 2012, using Survey 2 and the Coach Survey (Appendix I and Appendix J). The link to the surveys was distributed via email by the researcher in early November, 2012. Only those teachers who completed the first survey, agreed to participate in the second survey, and provided their email addresses were invited to participate in the second survey. The email included a unique three-digit code (created by an online random number generator) to allow the researcher to match participant data collected on each of the surveys. The code was a required field on the first page of the survey. The informational flyer that explained the purpose of the study and a description of the incentives was also provided (Appendix H). Following the researcher's invitation to participate in the survey, representatives from each of the summer conference providers sent follow-up emails to encourage their respective teachers to complete the survey.

The Coach Survey was distributed via email by the researcher in mid-November, 2012. The survey was sent to all PBL coaches or lead teachers identified by teachers on

Survey 2. The email invitation to participate included a three-digit code that matched the referring teacher. The code was a required field on the first page of the survey.

Eighteen semi-structured interviews with teacher participants were conducted via telephone in December. The interviews ranged from 13 minutes in length to 42 minutes, for a total of just over six hours, or an average of 33 minutes each. Interviewees were selected from those participants who completed Survey 2 and indicated on the survey that they would be willing to participate in an interview. The selection process involved reviewing demographic data and selecting a balanced representation of NT and Non-NT schools, elementary, middle, and high schools, a variety of core academic subjects, and a wide range of years of teaching experience. The purpose of the interviews was to gain a deeper understanding of responses given on the survey. A summary of interviewee profiles is provided in Table 12 and a copy of the interview guide is provided in Appendix K.

Table 12

Interviewee Profile Summary

NT vs. Non-NT	
• NT	8
• Non-NT	10
Level	
• Elementary school	4
• Middle school	1
• High school	13
Academic Subject	
• All (Elemenatary)	4
• English/Language Arts	3
• Social Studies	3

• Science	5
• Math	2
• Technology	1
Years of Teaching Experience	
• Less than 1 year	3
• 1-5 years	1
• 6-10 years	3
• 11-20 years	7
• 21-30 years	3
PBL Experience (Raw Scores)	
• 4-5	6
• 6-7	4
• 8-9	3
• 10-11	3
• 12-13	2
Extent of Implementation	
• Continued learning	1
• Created a plan	1
• Implemented 1 project	3
• Implemented 2-3 projects	5
• Fully adopted PBL	9

Analysis

Pre-analysis. To prepare for analysis, data cleaning procedures were conducted on each of the three sets of quantitative data (Survey 1 data, Survey 2 data, and Coach Survey data). Several types of responses were searched for and removed, including survey responses that were missing responses to a set of items on a scale, multiple responses from the same individual, responses to the motivational items that exceeded the 100-point scale, responses that had the same number across all three motivational scales, and outlier responses. After data cleaning was complete, 343 responses for Survey 1 were

retained, 187 responses for Survey 2 were retained, and 15 responses to Coach Survey responses were retained.

Computed variables were created, including means for each measure, *z* scores for PBL experience, and a grouping variable for Extent of Implementation. The *z* score for PBL experience was created from four items in the demographic section of Survey 1: 1) level of experience teaching PBL, 2) amount of experience as a learner in PBL, 3) amount of instruction about PBL received during pre-service education, and 4) amount of other PBL in-service training. Because these items were not all on the same scale, a z score was created to standardize the measures. The resulting *z* scores ranged from -3.10 to 9.18, with a standard deviation of 3.0. Next, a grouping variable was created for two levels of experience. Each level of experience (low and high) spanned two SDs. Those with a PBL experience value of -3.10 to 3 were coded with a grouping variable of one for low experience; those with a value of > 3 were coded with a grouping variable of 2, for high experience.

A grouping variable was also created for low, moderate, and high levels of PBL implementation. Those who indicated on Survey 2 that they either did not pursue any PBL-related activity, continued learning about PBL, or designed a project to be implemented later were coded with a 1 for no implementation; those who indicated they implemented one to three projects were coded with a 2 for some implementation; those who indicated that they fully adopted PBL in their classroom during the semester were coded with a 3 for fully adopted.

Data cleaning was also performed on qualitative data obtained through Survey 2. The data were copied from the spreadsheet into Microsoft Word. The text was converted to a two-column table in Word, with the responses in one column and a second column for entering codes. Responses that contained more than one idea were separated into separate rows in the table. Responses for which the meaning could not be deciphered were eliminated from the analysis.

Analytical Procedures Overview. Below are descriptions of the analytical procedures for each research question. How do newly prepared PBL teachers in New Tech Network schools compare with those in non-New Tech Network schools in self-efficacy, outcome expectancy, task value, perceptions of school conditions, and extent of PBL implementation? An independent samples *t* test was conducted to compare the means between the two groups on each of the variables of interest.

What is the role of newly prepared PBL teachers' motivational beliefs, perceptions of school conditions, and PBL experience in the extent of PBL implementation? A hierarchical multiple linear regression analysis was conducted to examine individual and combined effects of these variables. The hierarchical approach to the regression was selected because the regression in this situation was designed to test theoretical assumptions about the variables of interest and to examine the relative importance of independent variables in explaining variance in the dependent variable (Cohen, 2001).

1. How do newly prepared teachers' motivational beliefs, perceptions of school conditions, and intention to implement PBL reported immediately

after PBL training compare with their motivational beliefs, perceptions of school conditions and extent of implementation during the first two months of school following the PBL training? A paired samples *t* test was conducted to compare means between the first survey and second surveys. Responses provided by participants on the first survey were matched with responses provided by the same participants on the second survey through the use of a numerical code.

2. What do newly prepared PBL teachers report as factors that impacted implementation and motivation during their first two months of implementation efforts? To answer this question, responses to open-ended questions were analyzed using categorizing strategies (Maxwell, 2005) in two separate steps. In step one, survey data were coded by the researcher using an open-coding system. Responses were tallied and summarized by category. Inter-rater reliability was established by randomly selecting 30% of the data to be coded by a second, blind rater who had been trained in the coding scheme. The second rather used the codes identified by the first rater. A Cohen's Kappa was calculated, with a target minimum of .7.

4. Results

The overall purpose of this study was to better understand newly prepared PBL teachers' motivational beliefs and perceptions of school conditions as they relate to the teachers' extent of PBL implementation. The results presented in this section are organized into sub-sections for descriptive statistics, exploratory analysis, and findings for each research question.

Descriptive Statistics

The statistics in this section pertain to Survey 2 only. To provide a summary of the Survey 2 data, frequencies, means, and correlations were calculated. Means and standard deviations for key variables of interest for all Survey 2 participants (N = 186) are provided in Table 13. As shown in the table, the highest mean for the motivational variables was task value (M = 83.33, SD = 16.39). The mean self-efficacy (M = 81.90, SD = 12.48) is higher than mean outcome expectancy (M = 77.02, SD = 16.63). A table containing means and standard deviations for each individual item on the three motivational scales (Time 2) is found in Appendix A. Of all individual items on the three motivational scales, the only means that were less than 80 were the self-efficacy items, "I can teach students self-regulation skills (such as goal-setting, self-monitoring, reflection)" (M = 79.33, SD = 15.86) and "I can effectively manage classroom time during PBL" (M = 79.19, SD = 16.99), and the outcome expectancy item, "Most or all students will learn to manage their own learning" (M = 79.38, SD = 17.09). Of all

individual items on the three motivational scales, the only means that were greater than or equal to 90 were the task value items, "Will you learn new teaching skills by teaching with PBL?" (M = 91.12, SD = 13.06) and "How useful are the skills that students learn through PBL?" (M = 93.02, SD = 11.66).

Table 13

Means and Standard Deviations for Motivational Variables, Perceptions of School Conditions, and Extent of PBL Implementation for Non-NT and NT

Variable	Mean (SD)
Self-efficacy	81.90 (12.48)
Outcome expectancy	77.02 (16.63)
Task value	83.33 (16.39)
Perceived school conditions-teacher participation	2.60 (.78)
Perceived school conditions-school structure	2.45 (.89)
Extent of Implementation	4.66 (1.35)

Table 14 illustrates the extent of implementation for Non-NT and NT teachers. As shown, the majority of Non-NT teachers (50.5%) implemented one project, while the

majority of the NT teachers (67%) fully adopted PBL. Descriptions of implemented projects, provided by teachers in this study, are provided in Appendix L.

Table 14

Extent of PBL Implementation for Non-NT and NT Teachers

Extent of Implementation	Frequency Reported (N = 186)	Percent
No PBL Activity		
Non-NT (96)	3 (97)	3.1
NT (90)	4 (90)	4.4
Learning only		
Non-NT (96)	7 (97)	7.2
NT (90)	1 (90)	1.1
Created a plan only		
Non-NT (96)	12 (97)	12.4
NT (90)	4 (90)	4.4
Implemented 1 project		
Non-NT (96)	49 (97)	50.5
NT (90)	6 (90)	6.7
Implemented 2-3 projects		
Non-NT (96)	15 (97)	15.5
NT (90)	15 (90)	16.7
Fully adopted PBL		
Non-NT (96)	11	11.3
NT (90)	60	66.7

To determine the frequency with which teachers used specific aspects of PBL (regardless of the extent to which they implemented PBL), frequencies and means for were calculated. The three PBL elements that teachers reported using most frequently were: 1) assessment of students' 21st Century skills (75% of teachers reported using frequently, always, or almost always), 2) rubrics (74% of teachers reported using

frequently, always, or almost always), and 3) scaffolds (75% of teachers reported using frequently, always or almost always) (Table 15).

Table 15

Means, Standard Deviations, and Frequency of Teacher Use of PBL Elements for NT and Non-NT Teachers

PBL Element	Mean	Number of Times Reported as Frequently, Always, or Almost Always Used
A driving question, essential question, or problem statement to focus the learning	2.94 (.96)	119 (64%)
Assessments of students' 21st Century skills, such as teamwork, presentation skills, critical thinking, etc.	3.13 (.87)	140 (75%)
Activities that required students to find answers to questions through their own research	2.92 (.94)	121 (65%)
Rubrics for assessing student work on projects	3.12 (.91)	138 (74%)
Student-generated activities or research questions	2.94 (.98)	72 (39%)

The activities in which students most frequently participated were: 1) Work collaboratively (85%), 2) Rely on logic, reasoning, and discussions with peers to answer questions (69%), and 3) Take responsibility for their own learning (67%) (Table 16).

Table 16

Means, Standard Deviations, and Frequency of Student PBL Activity for NT and Non-NT Teachers

Student PBL Activity	Mean	Number of Times Reported as Frequently, Always, or Almost Always Done
Collect, organize, and analyze information and data	2.75 (.87)	115 (62%)
Solve real world problems	2.70 (.89)	106 (57%)
Work collaboratively in groups	3.30 (.71)	159 (85%)
Rely on logic, reasoning, and discussions with peers to answer questions	2.84 (.74)	128 (69%)
Decide how to present what they had learned	2.60 (.88)	97 (52%)
Demonstrate their learning by developing products and presentations	2.85 (.96)	116 (62%)
Present evidence to support their ideas or views	2.84 (.91)	121 (65%)
Develop their own questions or "need to knows"	2.79 (.91)	113 (61%)
Decide how and where to get the information they needed to answer questions	2.61 (.81)	99 (53%)
Orally present their work to peers, staff, parents, or others	2.72 (.97)	107 (58%)
Evaluate or critique other students' work	2.34 (.89)	74 (40%)
Take responsibility for their own learning	2.87) (.84)	124 (67%)

An optional question on Survey 2 asked teachers to provide the name and email address for a PBL coach or lead teacher who is knowledgeable about their classroom practices. In response to this question, twenty-four teachers (13%) provided a name and contact information for someone who fit these criteria. Subsequently, the Coach Survey was distributed to the PBL coaches and lead teachers who were identified. The Coach Survey asked the PBL coaches and lead teachers to report the extent of PBL implementation for the teacher who had referred them, as well as the teacher's frequency of use of the 18 PBL implementation components included in Survey 2. Fifteen of the 24 coaches responded, for a response rate of 63%. A paired samples *t* test was conducted to determine whether there was a significant difference in the means reported by the teachers and their coach/lead teacher on each of the items. There was no significant difference between the overall extent of implementation reported by teachers and that reported by the matched coaches/lead teachers. Further, there was no significant difference between the frequency of use of any of the 18 individual PBL components reported by teachers and that reported by PBL coaches/lead teachers. As another means of validating the data, a Pearson's Correlation was conducted on the means for all 18 items reported by teachers and the PBL coaches and lead teachers. The total means for the 18 items were highly correlated between the two groups ($r = .83$, $p < .01$).

Using data collected via Survey 2, Pearson's Correlations were conducted to identify relationships among select teacher demographic variables, the constructs for

motivation and perceptions of school conditions, and extent of PBL implementation. Because of the contextual differences between Non-NT and NT teachers, these two groups were analyzed separately. Correlation values ranging from .20 to .39 are interpreted as low; values from .40 to .49 are interpreted as moderate; and values at .50 or greater are interpreted as high (Green & Salkind, 2011).

Non-NT Teachers

The correlations for Non-NT teachers (N = 96) are shown in Table 17. One of the key variables of interest is "Extent of PBL Implementation," which indicates the level of PBL activity—on a continuum from no PBL activity to fully adopting PBL—teachers completed during the first two months of school following the summer professional development conferences. The variable most highly correlated with Extent of PBL Implementation was PBL Experience ($r = .50$, $p < .01$), indicating that those teachers with more PBL experience implemented PBL to a greater extent. The variable that was the second most highly correlated with Extent of PBL Implementation was perceptions of school conditions-school structures, ($r = .40$, $p < .01$), which suggests that those teachers with more positive perceptions of school structures, such as policies aligned with PBL, adequate planning time, and adequate access to technology, implemented PBL to a greater extent. The next variable most highly correlated with extent of PBL implementation is task value, ($r = .41$, $p < .01$); those teachers who like and value PBL more also implemented PBL to a greater extent. This was followed by perceptions of school conditions-school structures ($r = .40$, $p < .01$). Self-efficacy ($r = .23$, $p < .05$) and

perceptions of school conditions-teacher participation ($r = .22$, $p < .05$) had low levels of correlation with extent of PBL implementation.

Self-efficacy, outcome expectancy, and task value are highly correlated with each other. Each of these variables has a low, positive correlation with PBL experience (self-efficacy, $r = .24$, $p < .05$), (task value, $r = .34$, $p < .01$), (outcome expectancy, $r = .23$, $p < .05$). Outcome expectancy is also correlated, at a low level, with perceptions of school conditions-teacher participation, $r = .39$, $p < .01$).

Years as a teacher is negatively correlated with task value ($r = -.24$, $p < .05$), perceptions of school conditions-teacher participation ($r = -.29$, $p < .01$), and perceptions of school conditions-school structures ($r = -.41$, $p < .01$).

Table 17

Correlations Among Variables, Non-NT Teachers

Variable	1	2	3	4	5	6	7	8	9	10
1. PBL Experience	1									
2. Years as a teacher	-.13 .19	1								
3. Subject	.11 .30	-.37** .00	1							
4. Geography	-.20 .85	.39** .00	-.10 .33	1						
5. Self-efficacy	.24* .02	-.13 .21	-.03 .74	.10 .36	1					
6. Task value	.34** .00	-.24* .02	.00 .98	-.24* .02	.55** .00	1				
7. Outcome	.23*	-.20	-.03	-.17	.67**	.69**	1			

expectancy	.03	.05	.78	.11	.00	.00				
8. School conditions-teacher participation	.20 .06	-.29** .00	.09 .39	-.22* .03	.30* .03	.26* .01	.39** .00	1		
9. School conditions-school structures	.28** .01	-.41* .00	.22* .03	-.33** .01	.21* .04	.27** .01	.25* .02	.65** .00	1	
10. Extent of Implement-ation	.50** .00	-.13 .22	-.09 .38	.05 .64	.23* .02	.41** .00	.32** .00	.22* .03	.40** .00	1

*$p < .05$ **$p < .01$

NT Teachers

The correlations for NT teachers (Table 18) are similar to those for the Non-NT teachers. Extent of PBL implementation is moderately correlated with task value ($r = .46$, $p < .01$) and perceptions of school conditions-school structures, $r = .39$, $p < .01$). PBL Experience is correlated with self-efficacy ($r = .26$, $p < .01$).

Self-efficacy, task value, and outcome expectancy are correlated with each other. There is a low level, positive correlation between outcome expectancy and years as a teacher ($r = .25$, $p < .05$). Task value is correlated with perceptions of school conditions-school structures, $r = .35$, $p < .01$.

Table 18

Correlations Among Variables, NT Teachers

Variable	1	2	3	*4*	5	6	7	8	9	10

1. PBL Experience	1									
2. Years as a teacher	.14 .18	1								
3. Academic subject	.12 .27	.10 .35	1							
4. School location	-.10 .35	-.01 .95	.06 .61	1						
5. Self-efficacy	.26* .01	.21 .05	-.05 .66	.08 .46	1					
6. Task value	.20 .06	.18 .09	-.12 .26	-.10 .37	.50** .00	1				
7. Outcome expectancy	.13 .22	.25* .02	.01 .96	-.01 .95	.33** .00	.54** .00	1			
8. School conditions-teacher participation	.07 .49	.08 .47	.28* .01	-.03 .78	.05 .62	.18 .09	.09 .39	1		
9. School conditions-school structures	-.03 .80	.02 .47	.28** .01	-.14 .19	-.03 .76	.35** .00	.16 .12	.57** .00	1	
10. Extent of Implement-ation	.17 .10	.06 .56	-.50 .64	.12 .25	.17 .10	.46** .00	.19 .08	.17 .11	.39** .00	1

*$p < .05$ **$p < .01$

Exploratory Analysis

To gain further insight into the differences in motivation and perceived school conditions among teachers with different levels of extent of PBL implementation, a one-way ANOVA was conducted on key measures for those with no implementation, some PBL implementation (1-3 projects), and full adoption of PBL (Table 19). There were

significant differences between groups on all three motivational variables and both perceptions of school conditions variables. For each variable, the participant groups with greater extent of implementation had higher measures on each of those variables. The three variables with the greatest effects were perceptions of school conditions-school structures, $F(2, 184) = 59.53$, $p < .001$, task value, $F(2,184) = 22.08$, $p < .001$, and perceptions of school conditions-teacher participation, $F(2,184) = 14.97$, $p < .001$. For perceptions of school conditions-school structures, there was a mean difference of 1.35, $p < .05$ between the fully adopted group (N = 72) and the no implementation group (N = 29), and a mean difference of 1.15, $p < .05$, between the fully adopted group and the some implementation group (N = 85). For task value, there was a mean difference of 21.13, $p < .05$, between the fully adopted group and the no implementation group, and a mean difference of 12.03, $p < .05$, between the fully adopted group and the some implementation group. For perceptions of school conditions-teacher participation, there was a mean difference of .66, $p < .05$, between the fully adopted group and the no implementation group, and a mean difference of .58, $p < .05$, between the fully adopted group and the some PBL implementation group.

Table 19

Comparison of Means by Level of Implementation

Measures	No PBL implementation (N = 29)	Some PBL implementation (N = 85)	PBL fully adopted (N = 72)	*F*	*df*
PBL				10.34**	185

Experience	-1.73 (1.57)	-.18 (2.94)	1.03 (3.09)		
Self-efficacy	76.40 (10.55)	81.62 (13.71)	84.44 (11.01)	4.42**	184
Outcome expectancy	68.10 (17.93)	76.94 (15.51)	80.71 (16.21)	6.28**	185
Task Value	69.64 (20.27)	81.67 (15.40)	90.77 (11.00)	22.08**	184
Perceptions of School Conditions-Teacher Participation	2.31 (.67)	2.40 (.74)	2.97 (.74)	14.97**	185
Perceptions of School Conditions School-Structures	1.83 (.75)	2.04 (.74)	3.19 (.72)	59.53**	185

**$p < .001$, *$p < .005$

Further, since the correlational analysis indicated that PBL experience might be important in terms of extent of PBL implementation, an independent samples *t* test was conducted to compare measures of motivational beliefs, perceptions of school conditions, and extent of implementation for groups with low and high levels of PBL experience (

Table 20). There were significant differences between the groups on all measures, with the exception of perceptions of school conditions-school structures. The low PBL experience group's self-efficacy (M = 78.11, SD = 13.11) was significantly lower than the high PBL experience group's self-efficacy (M = 85.19, SD = 10.95); $t(183) = 3.99$, $p < .001$. The low PBL experience group's outcome expectancy (M = 73.74, SD = 18.10) was significantly lower than that of the high PBL experience group (M = 79.91, SD = 14.72); $t(184) = 2.56$, $p < .05$. The low PBL experience group's task value (M = 79.04,

SD = 17.12) was also significantly lower than that of the high PBL experience group (M = 87.05, SD = 14.83); $t(183) = 3.41$, $p < .01$. The low PBL experience group's perceptions of school conditions-teacher participation (M = 2.48, SD = .79) was also significantly lower than that of the high PBL experience group (M = 2.71, SD = .77); $t(183) = 2.00$, $p < .05$. Finally, the low PBL experience group's extent of implementation (M = 4.26, SD = 1.40) was lower than the high PBL experience group's extent of implementation (M = 5.00, SD = 1.21); $t(183) = 3.85$, $p < .001$. There was no significant difference between groups on perceptions of school conditions-school structures.

Table 20

Comparison of Means by Level of PBL Experience

Measures	Low PBL Experience (N = 86)	High PBL Experience (N = 99)	*t*	*df*
Self-efficacy	78.11 (13.11)	85.19 (10.95)	3.99***	183
Outcome expectancy	73.74 (18.10)	79.91 (14.72)	2.56*	184
Task value	79.04 (17.12)	87.05 (14.83)	3.41**	183
Perceptions of school conditions-Teacher Participation	2.48 (.79)	2.71 (.77)	2.00*	184
Perceptions of cchool conditions-school structures	2.31 (2.57)	2.57 (.89)	1.89	184
Extent of implementation	4.26 (1.40)	5.00 (1.21)	3.85***	184

*** $p < .001$ ** $p < .01$ * $p < .05$

Another ANOVA was conducted to compare mean measures by elementary, middle, and high school (

Table 22). It was important to perform this comparison, since there was a substantial difference between NT and non-NT in the distribution of teachers among the three school levels. Data from both groups were utilized in this analysis (N = 186). There were no significant differences between groups on the motivational variables or perceptions of school conditions-teacher support. There were significant differences between the groups on perceptions of school conditions-school structures, $F(183) = 13.92$, $p < .001$ and the extent of implementation measure, $F(183) = 5.73$, $p < .005$. The two measures were positively associated with the level of school. The elementary group school conditions-school structures (M = 1.90, SD = .84) measure was significantly lower than that of the middle school group (M = 2.42, SD = .89), $p < .05$. The elementary group was also significantly lower on this measure than that of the high school group (M = 2.71, SD = .90), $p < .001$. On the extent of implementation measure, the elementary school group (M = 4.13, SD = .97) was significantly lower than that of the high school group (M = 4.91, SD = 1.36), $p < .005$. There were no significant differences between elementary and middle or middle and high school.

Table 22

Comparison of Means by School Level

Measures	Elementary School (N=47)	Middle School (N = 33)	High School (N = 105)	*F*	*df*
Self-efficacy	82.29 (13.38)	84.47 (12.84)	80.92 (11.95)	1.05	182
Outcome expectancy	79.54 (14.68)	74.93 (18.67)	76.55 (16.79)	.84	182
Task Value	81.49 (16.08)	85.54 (15.30)	83.45 (16.91)	.60	183
Perceptions of school conditions-Teacher Participation	2.44 (.76)	2.53 (.73)	2.70 (.80)	1.96	183
Perceptions of School Conditions-School Structures	1.89 (.84)	2.42 (.89)	2.71 (.90)	13.92***	183
Extent of Implementation	4.13 (.97)	4.61 (1.56)	4.91 (1.37)	5.73**	183

*** $p < .001$ ** $p < .01$ * $p < .05$

Research Question 1 Results

Research question one was, "How do newly prepared PBL teachers in New Tech Network schools compare with those in non-New Tech Network schools in self-efficacy, outcome expectancy, task value, perceptions of school conditions, and extent of PBL implementation?" Since teachers who work at NT schools have actively chosen to join a school where full PBL implementation is required, and the schools have been designed

specifically to support PBL, it was expected that there would be differences between the NT and Non-NT teachers on each of these measures. To answer this question, two independent samples *t* tests were conducted, analyzing Time 1 data and Time 2 data separately. As shown in Table 24, NT teachers had significantly higher measures on four of six variables on both Time 1 and Time 2. Time 2 data are highlighted here, since this is the data relevant to Research Question 2 regarding the role of these variables in extent of implementation, as these data reflect motivational beliefs and perceptions of school conditions after two months of efforts to implement PBL.

As shown in Table 24, the NT teachers' Time 2 task value (M = 87.53, SD = 14.11) was significantly higher than the Non NT teachers' Time 2 task value (M = 78.75, SD = 18.58); $t(184) = 3.65$, $p < .001$. NT teachers' reported perceptions of school conditions-teacher participation measure (M = 2.89, SD = .72) was also significantly higher than that of Non-NT teachers' (M = 2.34, SD = .75); $t(184) = 5.05$, $p < .001$. The measure with the greatest difference between the two groups was perceptions of school conditions-school structures. NT teachers had more positive perceptions (M = 3.08, SD = .69) than Non-NT teachers (M = 1.87, SD = .74); $t(184) = 11.66$, $p < .01$. The extent of PBL Implementation was also significantly higher for NT teachers (M = 5.30, SD = 1.21) than for Non-NT teachers (M = 4.02, SD = 1.15); $t(184) = 7.70$, $p < .01$. There was no significant difference between the two groups on self-efficacy or outcome expectancy. A comparison of means between NT vs. Non-NT teachers on individual scale items for Time 1 and for Time 2 are provided in Appendix B and Appendix C.

Table 24

Comparison of Means of Non-NT and NT Teachers, Time 1 and Time 2

Variables	Non-NT	NT	*t*	*df*
PBL Experience (z score) Time 1	-.39 (2.95)	.43 (3.02)	2.52	341
PBL Experience (z score) Time 2	.05 (3.19)	.04 2.74)	.40	184
Self-efficacy (Time 1)	81.58 (12.61)	81.82 (14.37)	1.60	341
Self-efficacy (Time 2)	80.66 (14.10)	83.26 (10.33)	1.42	184
Outcome Expectancy (Time 1)	79.39 (14.82)	82.66 (16.13)	1.96	341
Outcome Expectancy (Time 2)	75.13 (17.39)	79.08 (15.60)	1.63	184
Task Value (Time 1)	82.67 (13.71)	88.93 (13.81)	4.21***	341
Task Value (Time 2)	79.42 (17.43)	87.53 (14.11)	3.46***	184
Perceptions of school conditions-Teacher Participation (Time 1)	2.65 (.69)	3.22 (.62)	7.96***	341
Perceptions of school conditions-Teacher Participation (Time 2)	2.34 (.75)	2.89 (.72)	5.05***	184
Perceptions of School Conditions-School Structures (Time 1)	2.25 (.81)	3.29 (.70)	12.69***	341
Perceptions of School Conditions-School Structures (Time 2)	1.87 (.74)	3.08 (.69)	11.65***	184

Intention to Implement (Time 1)	4.78 (1.01)	5.75 (.67)	10.44***	341
Extent of PBL Implementation (Time 2)	4.02 (1.15)	5.35 (1.21)	7.70***	184

*** $p < .001$, * $p < .01$

Charts of the differences between NT and non-NT on Time 2 are provided in *Figure 2* and Figure 3.

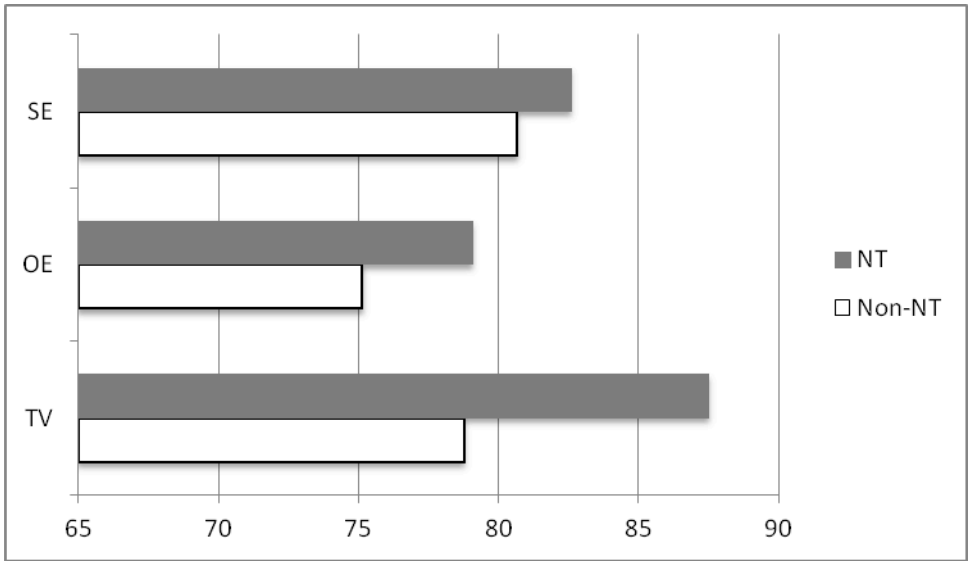


Figure 2. Motivational Beliefs, NT and Non-NT (Time 2).

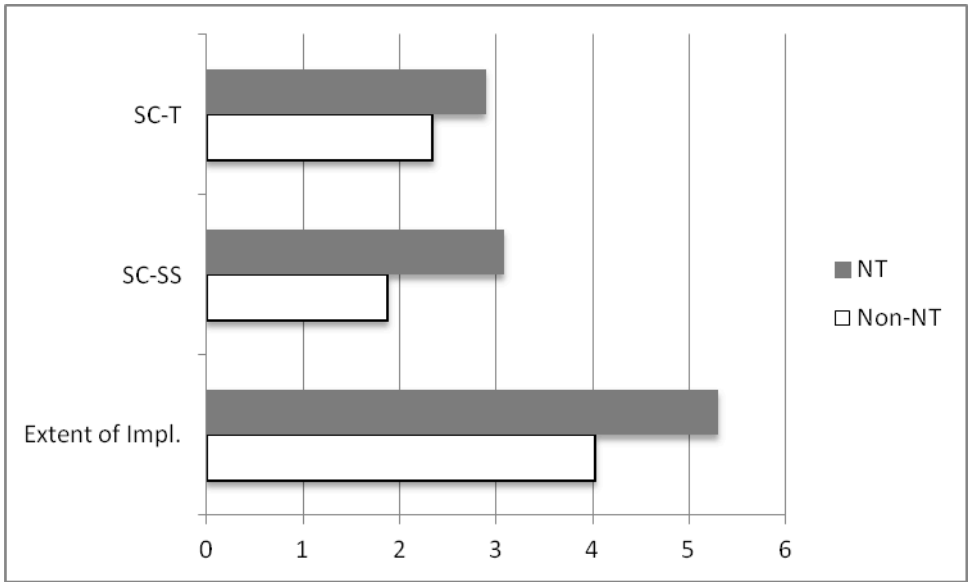


Figure 3. School Conditions and Implementation, NT and Non-NT (Time 2).

Research Question 2 Results

Research question 2 was, "What is the role of newly prepared PBL teachers' motivational beliefs, perceptions of school conditions, and PBL experience in the extent of PBL implementation?" To answer this question, a hierarchical multiple linear regression was conducted. Prior to conducting the linear regression, tests were conducted to ensure that the principle assumptions were met. There was no evidence of violations of assumptions. Also, the level of multicollinearity was determined to be acceptable. The variance inflation factor (VIF) values ranged from 1 to 3, while the tolerance values ranged from .333 to 1. Further, interaction terms were created and entered individually at the end of the model. No significant interactions among variables were found.

Four models were entered into the regression (Table 25). The models were designed based on Cohen and Cohen's (1983) recommendations for selecting and

sequencing independent variables according to theoretical basis, causal priority, and strong association with the dependent variable. Those variables that were correlated with extent of PBL implementation were selected for inclusion in the regression. The following seven variables were included: New Tech vs. Non-New Tech, PBL experience, perceptions of school conditions-school structures, perceptions of school conditions-teacher participation, task value, outcome expectancy, and self-efficacy.

Cohen and Cohen (1983) recommend entering demographic variables first, followed by dynamic variables, with those that are more likely to cause the others entered first. Based on this recommended procedure, Model 1 contained only the New Tech versus Non-New Tech variable, coded as a dummy variable (0 for Non-NT and 1 for NT), to serve as a control. This demographic variable was entered into the model first because the ANOVA revealed significant differences between the two groups on each of the variables of interest.

Model 2 contained the demographic variable, level of PBL experience. This variable was selected for inclusion in the model because it was correlated with extent of implementation for NT and Non-NT teachers. It was entered in the second model because it is a demographic variable, and therefore, should be entered before dynamic variables (Cohen & Cohen, 1983).

Model 3 contained the two perceptions of school conditions variables. These variables were selected for inclusion in the regression because they are correlated with extent of PBL implementation. The two perceptions of school conditions variables were sequenced from the strongest correlation with extent of implementation to the weakest

correlation with extent of implementation, with the school structures variable being entered before the teacher participation variable.

Model 4 contained the motivational variables, task value, outcome expectancy, and self-efficacy. These variables were selected for inclusion in the regression because they are correlated with extent of PBL implementation. The motivational variables were entered after the school conditions variables because of the theoretical assumption that the school conditions variables have a potential causal relationship with the motivational variables (Ford, 1992; Fullan, 2001; Lam, Cheng, & Choy, 2010). The three motivational the weakest correlation with extent of implementation.

The results of the regression indicated that each of the four models were positively associated with extent of implementation, and each model explained a significant portion of the variance in extent of PBL implementation (Table 25). In Model 1, the analysis revealed that implementing PBL at a NT school accounted for 24% of the variance in extent of implementation, $R^2 = .24$, $F(1, 182) = 58.31$, $p < .001$. In Model 2, the analysis revealed that PBL experience accounted for an additional 9% of the variance in extent of implementation, $R^2 = .37$, $F(2, 181) = 45.76$, $p < .001$. In Model 3, the analysis revealed that perceptions of school conditions accounted for an additional 10% of the variance in the extent of implementation, $R^2 = .43$, $F(4, 179) = 34.09$, $p < .001$. Of the two variables added to Model 3, only the school structures variable indicated a significant role in extent of implementation ($\beta = 0.47$, $p < .001$). In Model 4, the analysis revealed that motivation accounted for an additional 6% of the variance in the extent of implementation, $R^2 = .49$, $F(7, 176) = 23.93$, $p < .001$. Of the three variables added in

Model 4, only task value indicated a significant role in extent of implementation (β = 0.27, $p < .01$). Together, the variables in all four models accounted for 49% of the variance in the extent of implementation.

The resulting regression equation for the full model is: Predicted extent of implementation = .55(NT vs. non-NT) + .09(PBL experience) + .56(Perceptions of school conditions-school structures) + .02(Task value) + 1.75. This equation can be interpreted to mean that when all other variables are constant, extent of implementation is higher by .56 when the school is a NT school, rather than a non-NT school. Further, when the PBL experience measure increases by one unit, with other variables remaining constant, extent of implementation increases by .09. And, when perceptions of school conditions-school structures increases by one category (with other variables remaining constant), extent of implementation increases by .56. Finally, with other variables remaining constant, extent of implementation increases by .02 when task value increases by one.

Table 25

Regression Analysis of Time 2 Data

Variable	*B*	*SE B*	β	*t*	R^2	ΔR^2	*F*	ΔF
Model 1					.24	.24	58.31	58.31***
New Tech or Non-New Tech	1.33	.17	.50	7.64***				
Model 2					.34	.09	45.76	25.39***
New Tech or Non-New	1.33	.16	.50	8.14***				

Tech								
PBL Experience	.14	.03	.31	5.04***				
Model 3					.43	.10	34.09	15.23**
New Tech or Non-New Tech	.59	.20	.22	2.87**				
PBL Experience	.12	.03	.26	4.63***				
Perceptions School Conditions-School Structures	.68	.14	.47	5.01***				
Perceptions of School Conditions-Teacher Participation	-.16	.13	-.09	-1.20				
Model 4					.49	.06	23.93	6.32***
New Tech or Non-New Tech	.55	.20	.21	2.83**				
PBL Experience	.09	.03	.21	3.66***				
Perceptions of School Conditions-School Structures	.56	.13	.39	4.15***				
Perceptions of School Conditions-Teacher Participation	-.17	.13	-.10	-1.32				
Task Value	.02	.01	.27	3.43**				
Outcome expectancy	.16	.01	.00	.01				
Self-efficacy	-.00	.01	-.02	-.29				

*$p < .05$ **$p < .01$ ***$p < .001$

Research Question 3 Results

Research question three was, "How do newly prepared teachers' motivational beliefs, perceptions of school conditions, and intention to implement PBL reported immediately after PBL training compare with their motivational beliefs, perceptions of school conditions and extent of implementation during the first two months of school

following the PBL training? To answer this research question, a paired samples *t* test was conducted.

Non-NT. The results indicated that the mean for five of the six variables decreased significantly between the two times of measure (Table 26). Task value at Time 2 (M = 78.75, SD = 18.58) was significantly lower than the task value at Time 1 (M = 86.25, SD = 13.08); $t(96) = 5.35$, $p < .001$. Outcome expectancy at Time 2 (M = 75.13, SD = 17.38) was significantly lower than outcome expectancy at Time 1 (M = 80.41, SD = 14.95); $t(96) = 2.95$, $p < 005$. Perceptions of school conditions-teacher participation at Time 2 (M = 2.35, SD = .75) was significantly lower than at Time 1 (M = 2.68, SD = .72); $t(94) = 4.64$, $p < 001$. Perceptions of school conditions-school structures at Time 2 (M = 1.85, SD = .74) was significantly lower than at Time 1 (M = 2.21, SD = .81); $t(94) = 6.35$, $p < 001$. And, the mean for extent of actual PBL implementation (M = 4.02, SD = 1.15) was significantly lower than the extent of plan to implement (M = 4.90, SD = .90); $t(96) = 6.98$, $p < 001$. For Non-NT teachers, there was no significant change in the mean for self-efficacy between Time 1 and Time 2. The changes between measures one and two for non-NT teachers are shown in Table 26.

Table 26

Comparison of Means of Time 1 and Time 2 (Non-NT)

Variables	Time 1	Time 2	*t*	*df*
Self-efficacy	82.16 (11.63)	80.66 (14.10)	1.37	96

Outcome expectancy	80.41 (14.95)	75.13 (17.39)	2.95**	96
Task Value	86.25 (13.08)	78.75 (18.58)	5.35**	96
Perceptions of School Conditions-Teacher Participation	2.68 (.72)	2.35 (.75)	4.64**	94
Perceptions of School Conditions-School Structures	2.21 (.81)	1.85 (.74)	6.35**	94
Extent of Plans for Implementation/Actual Extent of Implementation	4.89 (.90)	4.02 (1.15)	6.98**	96

$p < .05$, ** $p < .01$

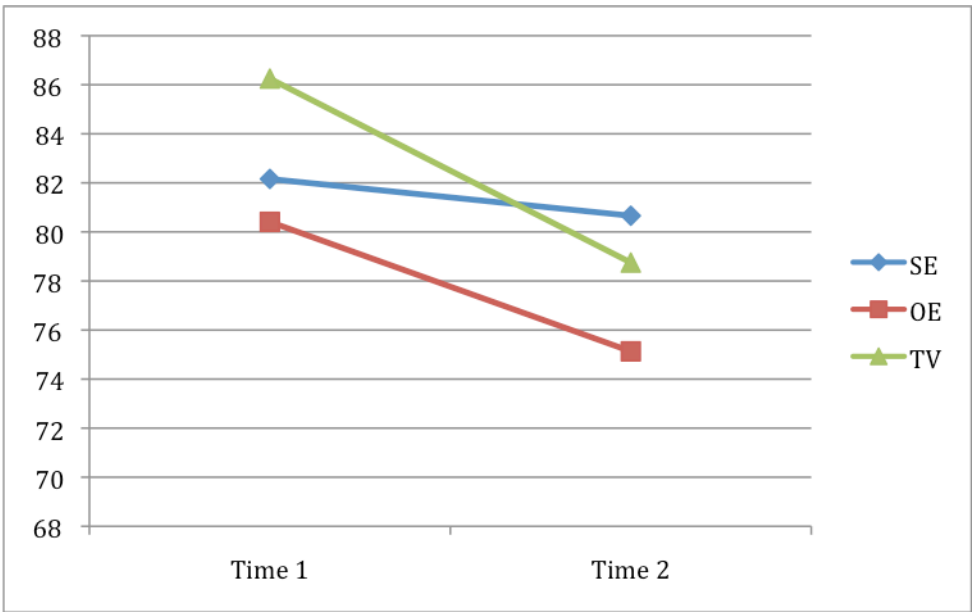


Figure 4. Change in Motivational Beliefs Between Times 1 and 2 (Non-NT).

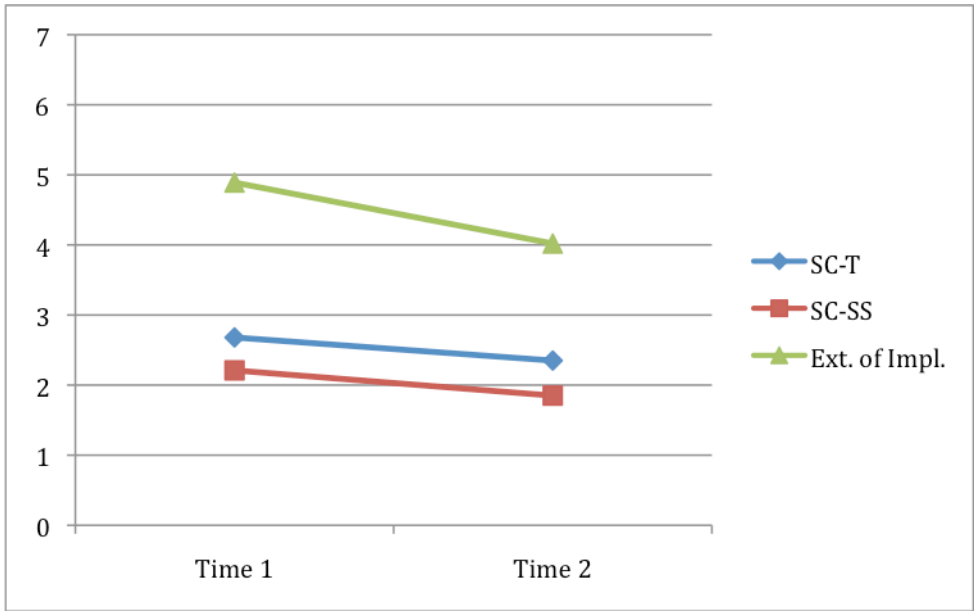


Figure 5. Change in Perceptions of School Conditions and Implementation (Non-NT).

NT. The results indicated that the mean for five of the six variables decreased significantly between the two times of measure (Table 27). Task value at Time 2 (M = 87.53, SD = 14.11) was significantly lower than the task value at Time 1 (M = 91.38, SD = 11.95); $t(89) = 2.97$, $p < .001$. Outcome expectancy at Time 2 (M = 79.08, SD = 15.99) was significantly lower than outcome expectancy at Time 1 (M = 83.83, SD = 14.36); $t(89) = 2.60$, $p < 005$. Perceptions of school conditions-teacher participation at Time 2 (M = 2.92, SD = .70) was significantly lower than at Time 1 (M = 3.27 SD = .63); $t(87) = 4.65$, $p < 001$. Perceptions of school conditions-school structures at Time 2 (M = 3.09, SD = .69) was significantly lower than at Time 1 (M = 3.33, SD = .68); $t(88) = 3.59$, $p < 001$. And, the mean for extent of actual PBL implementation (M = 5.35, SD = 1.21) was significantly lower than the extent of plan to implement (M = 5.84, SD = .45); $t(89) =$

4.82, $p < 001$. For NT teachers, there was no significant change in the mean for self-efficacy between Time 1 and Time 2. The changes between measures one and two for NT teachers are shown in Table 27.

Table 27

Comparison of Means for Time 1 and Time 2 (NT Teachers)

Measures	Time 1	Time 2	*t*	*df*
Self-efficacy	81.35 (13.63)	82.57 (12.14)	.97	88
Outcome expectancy	83.83 (14.36)	79.08 (15.60)	2.60*	88
Task Value	91.38 (11.95)	87.53 (14.11)	2.97**	88
Perceptions of School Conditions-Teacher Participation	3.27 (.63)	2.92 (.70)	4.65**	86
Perceptions of School Conditions-School structures	3.33 (.68)	3.09 (.69)	3.59**	87
Plans for Implementation/Actual Implementation	5.84 (.45)	5.35 (1.21)	4.82**	88

$p < .05$, ** $p < .01$

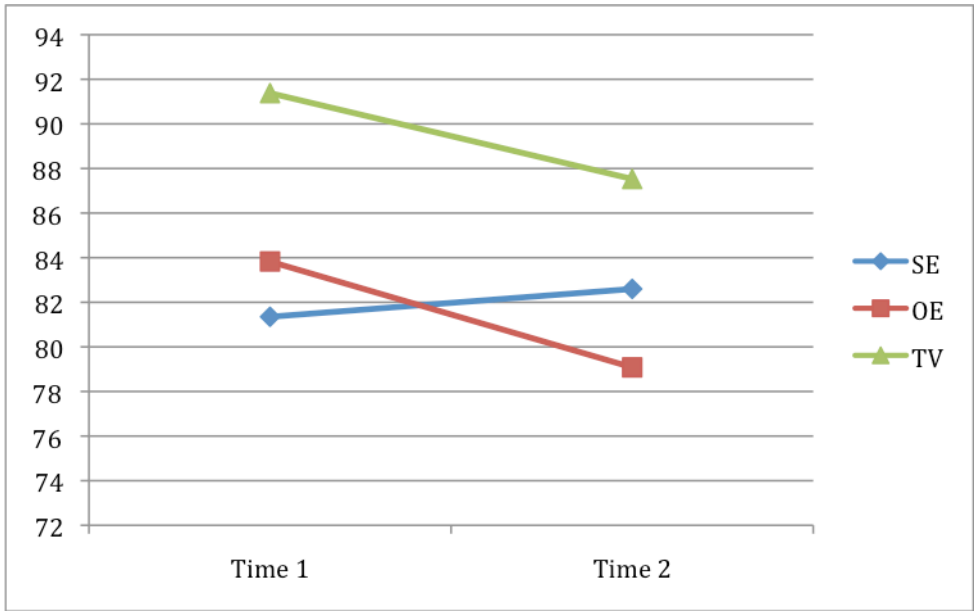


Figure 6. Change in Motivational Beliefs Between Times 1 and 2 (NT).

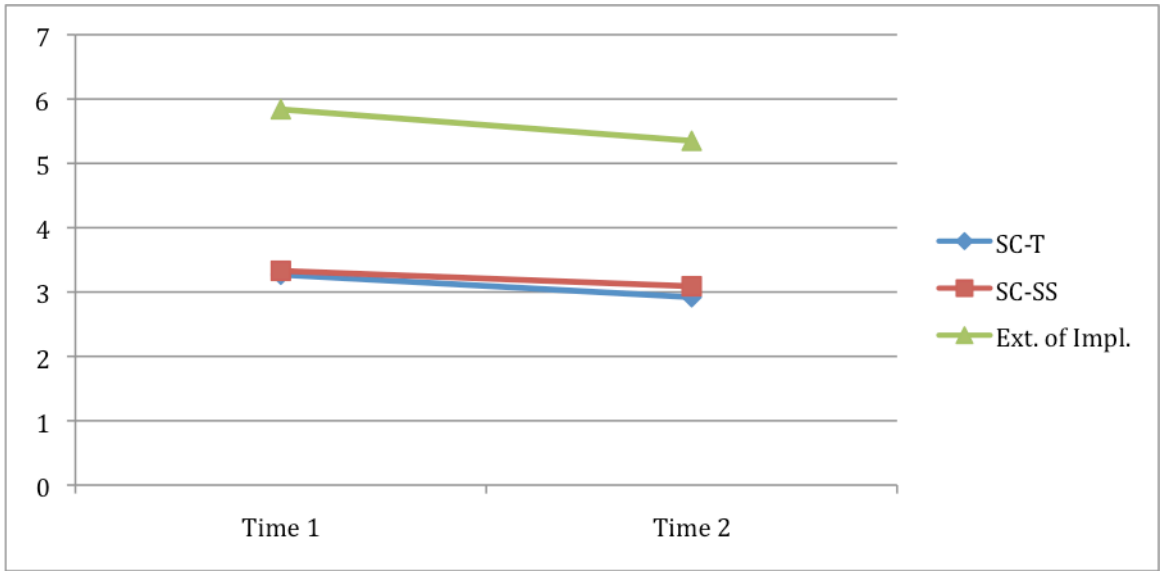


Figure 7. Change in Perceptions of School Conditions and Implementation (NT).

Comparisons of percent change for each of the variables examined in the paired samples *t* test for Time 1 and Time 2 are provided in Table 28. As shown here, the decreases in non-NT teachers' reported motivational beliefs, perceptions of school conditions, and intention versus actual implementation on the two surveys were substantially greater than those for NT teachers on four of six variables.

Table 28

Comparison of Percent Change for NT and Non-NT Teachers

Measures	Non-NT % Change	NT % Change
Self-efficacy	- 2	1
Outcome expectancy	- 7	- 6
Task Value	- 9	- 4
Perceptions of School Conditions-Teacher Participation	- 12	- 11
Perceptions of School Conditions-School structures	- 16	- 7
Intention to Implement/Actual Implementation	- 18	- 8

Research Question 4 Results

Research question four was, "What do newly prepared PBL teachers report as factors that impacted implementation and motivation during their first two months of implementation efforts?" To answer this question, the open-ended survey questions, "What factors have facilitated or hindered your implementation of PBL so far this

semester," and "What factors have contributed to or lessened your motivation?" were analyzed using categorizing strategies (Maxwell, 2005).

Factors that facilitated or hindered implementation. For the question about factors that impacted implementation, a total of 87 NT participants provided a response and 90 Non-NT teachers provided a response, for a total of 182 respondents to the question. Some respondents included more than one item in their response. For those responses that included more than one hindering or facilitating factor, a separate item was created for each factor mentioned. The items were first categorized as either hindering or facilitating, and then by topic. If the respondent did not indicate whether the factor was hindering or facilitating, the item was removed from the analysis. Factors determined to be unclear in meaning or irrelevant to the question were eliminated from the analysis. Each of the remaining 250 items were assigned a topic code and sorted. Topic codes were derived directly from key terms in the response, such "administrator support" or "computers," for example. The responses were then sorted by topic and tallied.

For this set of data, inter-rater reliability was established by randomly selecting 30% of the items (84) to be coded by a second rater. The second rater was a colleague of the researcher who was trained in the coding scheme. Interrater reliability for the initial coding attempt was found to be .69. While this level of agreement may be interpreted as "substantial," (Landis & Koch, 1977), improvement was sought. The coded items and the codes were reviewed to identify causes of discrepancies. Insights gained from this review were applied to improve agreement. Several of the codes were determined to be too close to allow clear distinction, and therefore, were consolidated into a single code, resulting in

23 codes. The number of codes was further reduced to 18 by putting the topics of time under a single "time" code. Further, some of the responses were determined to contain more than one topic, and therefore, were split into separate items. The revised code list contained 18 codes and the revised response list contained 260 items. After recoding, the interrater reliability was found to be Kappa = .84 ($p < .01$), a value that may be interpreted as "almost perfect agreement" (Landis & Koch, 1977).

The topics were analyzed to determine whether they were related to one or more of the three motivational variables or one of the perceptions of school conditions variables. The numbers of topics relating to each variable were tallied. There were 28 topics related to self-efficacy (SE), 41 related to student outcome expectancies (OE), eight related to school conditions—teacher participation (SC-T), and 142 related to school conditions—school structures (SC-SS). These designations appear in parentheses after the topic in Table 29.

Table 29

Factors that Hindered or Facilitated PBL Implementation

Topic	Category		
	Facilitated	Hindered	TOTAL
Time (SC-SS) • Classroom or curriculum • Planning • School Schedule (calendar, time of year, events, classroom) • Implementation of a new evaluation system • Workload, multiple projects, multiple classes	3	65	68

Perceived student issues (OE) • Abilities • Attitudes • Experience • Engagement • Behavior • Motivation • Self-regulated learning • Performance • Turnover/transience • Learning	5	36	41
Support or buy-in (SC-SS) • Teachers • Administration • District • Parents • Community	11	20	31
Technology (SC-SS) • Computers • Equipment • Internet • Access to, lack of, outdated, distraction	5	22	27
Experience, practice, knowledge, training (Mentors, internships, professional development) (SE)	1	14	15
School wide Emphasis (SC-Ss)	12	3	15
Resources, materials, costs, community contacts (SC-SS)	2	11	13
Community partners (SC-SS)	2	7	9
Standardized test scores or curriculum (SC-SS)	0	9	9
Collaboration, team, team teaching (teachers) (SC-T)	3	5	8
Culture (resistance to change or teaching habits) (SE)	1	7	8
Facilities (SC-SS)	1	3	4
Class size (SC-SS)	2	1	3
Project ideas (or authentic problems) (SE)	0	3	3

Student assessment or grading (SC-SS)	1	2	3
Complexity (SE)	0	1	1
Subject incompatibility (SE)	0	1	1
Teacher absence (other)	0	1	1
TOTAL	49	211	260

As shown in the table above, 49 facilitating factors (19%) were reported, while 211 hindering factors (81%) were reported. School wide emphasis (12, 5%) was the most frequently reported facilitating factor, with support (from administration, the district, parents, the community, or other teachers), being a close second (11, 4%). Both of these were identified as relating to the perceptions of school conditions-school structures variable.

The most frequently reported hindering factor was time (65, 25%), including not enough classroom time to cover the curriculum, not enough planning time, time impacts of the school schedule, time involved in implementing a new evaluation system, and overall workload (conducting multiple projects, teaching multiple classes, and involvement in other school priorities). This topic also relates to the variable, school conditions-school structures. One teacher noted the challenges of using PBL with a structured curriculum: “I work in a school with a curriculum calendar and that uses the eight-step process. There is very little time in the day that allows for PBL.” Another teacher expressed difficulty with finding time for planning:

> The amount of work that goes into planning a PBL can also hinder even the most well intentioned teachers; it requires A LOT of additional planning to thoroughly plan a project and make sure all the necessary components are present.

The second most frequently reported hindrances were related to perceived student issues (36, 14%). Specific hindering factors related to students, as teachers reported, covered issues such as student attitude, engagement, buy-in, motivation, ability to learn or self-regulate, behavior concerns, and turnover or transience. This topic was determined to be most aligned with the outcome expectancies variable. An example of a teacher response in this topic is:

> The students I have this year have not be very successful in school and don't have many of the skills to work on their own or with others and have very little confidence in their own abilities. Just trying to get them to do simple tasks is a struggle some days; sometimes it is lack of skills, sometimes lack of motivation, just depends on the student.

Another teacher described the challenges students face as they adjust to PBL: "Brand new PBL school with only freshmen who are still adapting, as are the staff, to the new learning environment. The students are having a difficult time adjusting to the responsibility." Students were also identified in some cases (5, 2%) as facilitating PBL: "My current group of students has been in at least one PBL classroom for the last two years. I'm able to do much more with them this year, because they're already PBL veterans."

The third most frequently reported hindering factor was technology, including lack of computers and other equipment, outdated computers, lack of Internet access, or students being distracted by the technology (22, 8%). Five teachers reported technology as facilitating their implementation.

The fourth most frequently reported hindering factor was related to lack of support or buy-in from administration, the district, parents, community, or other teachers (20, 7%). One teacher expressed that "Student/parent pushback to a new delivery have been frustrating at times." Another teacher expressed other difficulties related to lack of support: "Being the only teacher in my corporation doing PBL, not having review with peers, and no support from the administration—they prefer teaching to the test."

The fifth most frequently cited hindering factor was lack of experience, practice, knowledge, or training (14, 5%). This category relates most closely to the self-efficacy variable.

A sample of responses from the five categories with the most responses is provided Table 30, along with several others that were not in the top five categories. The responses are grouped by category. Each response is identified as being submitted by either a NT teacher or non-NT teacher.

Table 30

Sample Factors Reported as Impacting Implementation

1. Time
NT: I don't have enough time in my 44-minute class periods to get through the material I need to cover. Throwing in a PBL unit only puts me farther behind with my traditional

instruction.

NT: Being high-stakes state-tested requires me to move at a certain pace throughout the year to ensure I cover all materials. At times, I need to teach without PBL to ensure all students understand fundamental and/or vital content standards.

NT: The lack of structure within PBL has required increased planning on my part. As a first-year teacher, it's been damaging to devote so much time to planning and not enough time on developing relationships with parents, grading, classroom management, etc.

NT: Ensuring proper time allocation to each content standard evoked problems.

NT: Common planning time with my team has facilitated.

NT: The amount of work that goes into planning a PBL can also hinder even the most well intentioned teachers, it requires A LOT of additional planning to thoroughly plan a project and make sure all the necessary components are present.

Non-NT: I teach multiple courses so it is difficult to fully implement during my first year. Plus the demands of being a full time working parent make complete implementation difficult. I'm not complaining, I'm just being realistic. On the other hand, I am working harder than I ever have, but it is completely rewarding. I see my students creating quality work and being excited about it.

Non-NT: Time. The project we created over the summer took much longer than anticipated. I am at a disadvantage in that I only teach literature and it is hard to spend so much time covering so few standards.

Non-NT: Planning time has been a major hindrance to my teaching PBL due to having to plan an entirely new curriculum.

Non-NT: Lack of collaboration time has been an issue.

Non-NT: We currently use a curriculum map to decide what is taught each week. We also have many educational programs in place to increase student learning. Finding ways to incorporate PBL into the already crowded schedule has been a challenge.

Non-NT: Our administration has allowed me plenty of planning time.

2. Students

NT: The students struggle with understanding this concept. Since it is brand new, they struggle with understanding how to direct their own learning.

NT: Brand new PBL school with only Freshman who are still adapting, as are the staff, to the new learning environment. The students are having a difficult time adjusting to the responsibility.

NT: I cannot think of anything that has necessarily hindered my implementation. It is a

struggle, as always, to bring learners up to speed on the culture and the process, but this is a welcome challenge.

NT: Students have come to me this year very behind in standards and a lot of "catching up" has had to be done in order to have the basis for my projects which has hindered an early beginning to PBL. I just started a project last week.

NT: My current group of students has been in at least one PBL classroom for the last two years. I'm able to do much more with them this year, because they're already PBL veterans.

NT: The students have pushed back against the PBL method but I have held my ground and they have come through with final products and seen the need to be responsible for their learning.

NT: The students struggle with understanding this concept. Since it is brand new, they struggle with understanding how to direct their own learning.

Non-NT: Student behavioral problems have been a hindrance for the course. It is fueling doubt that PBL, which that relies on maturity and self-management, is right for certain classes.

Non-NT: Students do not work well in groups—many discipline issues and talking about unrelated topics. I've seen a lot of "good students" pulled down by others in their groups who don't do their work.

Non-NT: The students I have this year have not be very successful in school and don't have many of the skills to work on their own or with others and have very little confidence in their own abilities. Just trying to get them to do simple tasks is a struggle some days. Sometimes it is lack of skills, sometimes lack of motivation, it just depends on the student.

Non-NT: Students not being used to this type of learning. Many are not very independent learners and do not possess the critical thinking skills necessary to successfully learn from PBL.

Non-NT: The biggest struggle I have is that our incoming ninth grade class seems abnormally immature and apathetic. We have a shocking number of kids failing right now, and it makes me wonder if our implementation of PBL is failing or if this is just an unusually rough batch of students who would be failing even if I weren't trying to implement a new learning method.

Non-NT: The students' academic abilities have hindered implementing PBL. Since my students are so young, and struggling with grade level academics, it is hard for me to spend extra time discussing a project when I would rather be doing interventions to help them read and do basic skills.

Non-NT: The students' academic abilities have hindered implementing PBL. Since my students are so young, and struggling with grade level academics, it is hard for me to spend extra time discussing a project when I would rather be doing interventions to help them read

and do basic skills.

3. Support

NT: Administration has crippled the implementation of PBL.

NT: Tech issues and student/parent pushback to a new delivery have been frustrating at times.

NT: We are lacking administrative support this year and it's making it very difficult to do our job.

NT: Pushback from administration has hindered it.

NT: Department commitment to implement wall-to-wall projects facilities PBL across grade levels.

NT: My director is great at giving ideas and has facilitated and pushed me out of my comfort zone to help me implement PBL and new teaching strategies.

NT: The fact that my school is PBL-based and the director and facilitators are all working together to implement PBL has facilitated my implementation of PBL so far this semester.

NT: I am team teaching with someone who isn't completely buying into the idea of PBL. She likes the projects but believes they are wasting the time we could be using to teach. She would like to do more lessons with direct instruction and doesn't want to more fully put the responsibility of the learning in the hands of the students. On the other hand we are working with another teacher who believes that we should only work in PBL and that we should provide no instruction (other than scaffolding) unless the students request it. This pulls me in multiple directions.

NT: Helping our implementation has been a strong group of teachers who have bought into the value of teaching in the PBL model. Also, the New Tech Network has provided PD and resources to help along the way.

Non-NT: Being the only teacher in my corporation doing PBL, not having review with peers, no support from administration (they prefer teaching to the test).

Non-NT: Factors that have facilitated implementation of PBL: Support from colleagues and administrators, collaboration with grade level and special area teams.

Non-NT: A strong culture of family and learning has facilitated great PBL. Students buy in to the authenticity of the projects, the real world learning styles, and excitement of facilitators. PBL has been hindered by outside forces such as district mandates of common assessments and lack of full district support.

Non-NT: My school has been very successful with improving student performance. It is difficult to change the curriculum presentation when the current one is working. It is also difficult to implement in a co-teaching environment when co-teacher has not been through training.

Non-NT: I think one thing that hinders PBL sometimes is time and a lack of collaboration since I was the only one doing the PBL in my building. I was able to go to the PBL think tank that Wayne is providing, which helped.

Non-NT: Only two teachers implementing PBL in school. Coordinating activities between classes.

Non-NT: Our school is a 21st century, problem-based learning school, so having colleagues who are all on board has been a huge help as well. We truly believe in the importance of providing students the opportunities to work collaboratively and creatively while solving real-world problems.

Non-NT: I have relied on my parents to assist their child in getting the pieces to put our project together. I assumed that the students would understand as we discussed and reviewed my own photos of what the project could be. Kindergarten needed more teacher guidance. I highlighted the driving questions and the final project plan sending it home to parents with specific instructions on what the expectations are. What came back was very discouraging. I am ready to try again and keep the project closer to me.

Non-NT: Being a part of a PBL school has helped me build my knowledge and understanding of PBL instruction.

Technology

NT: Technology was a hindrance both in finding a way to capture and share videos of students as well as the camera/iPad was distracting to many students. They became distracted, wanting to play with it, and not wanting to perform.

NT: Network issues.

NT: Technology issues that include connectivity problems and broken laptops have hindered.

NT: Computers, software, etc. are outdated.

NT: Technology hindered and facilitated implementation. Great access to information and ways to collaborate through Google Docs were great, but it is also very distracting for the students. I am constantly battling their wanting to play games or look up stuff not related to class.

NT: The New Tech Network training and ECHO (Collaborative learning system) have helped greatly.

Non-NT: We were limited with our space and technology initially, since we did not have access to our laptops until October.

Non-NT: Forced to do traditional art projects with few supplies and no technology.

Non-NT: Hindered: Lack of technology or laptops for each kids.

Non-NT: Critical problems with technology that have not yet been resolved have been a challenge.

Non-NT: Technology issues were detrimental—no servers, no Internet, etc.

Non-NT: Lack of computers and specific programs.

Experience

NT: I'm overwhelmed with the process. I've done 3 projects so far and have been successful with different parts of the PBL process in each one. I need to be good at each part of the process in each project, but I'm just not there yet.

NT: I don't know enough about PBL to effectively and correctly implement it.

NT: My newness to PBL has hindered my implementation because I sometimes do not know how to handle situations when students do not want to cooperate or be engaged.

NT: Since the process is new not only to me, but to our whole staff and all of our students, it has been a major paradigm shift.

NT: It is an extremely difficult method to adopt. I make quite a few mistakes, but other than that, all of my coworkers have been amazing in helping me.

NT: I have 21 years of traditional teaching experience. I have been inundated with new teaching strategies and training opportunities, which I have taken advantage of, but it will take me additional time to incorporate all this into my daily routine. I am unlearning, relearning, and refining old practices to integrate them into PBL practices.

NT: I am new to the process, so it is a huge learning curve for me. That has been my biggest hurdle. The fact that we do PBL school wide has facilitated this for me.

NT: It is difficult for me to trust the students to engage in something at the depth and level necessary to meet standards and expectations.

Non-NT: Striking a balance between the "traditional classroom," in class (and school) expectations, and "giving up the reigns" have been difficult aspects of PBL for me.

Non-NT: Being a first year teacher in general has hindered implementing PBL as well. I feel like I have been trying to get a grasp on how to teach well in general, let alone implementing extra projects with tons of extra time and work that comes with each new project.

Non-NT: Professional development has facilitated my implementation.

Non-NT: Being a first year teacher in general has hindered implementing PBL as well. I feel like I have been trying to get a grasp on how to teach well in general, let alone

implementing extra projects with tons of extra time and work that comes with each new project.

Non-NT: We are teaching a combined course. It's a process of getting to know the team and how to manage PBL at the same time.

Non-NT: Difficult to implement in a co-teaching environment when co-teacher has not been through training.

Non-NT: Lack of priority in managing my time and balancing that with PBL.

Non-NT: Hindered: Lack of overall experience.

Other

NT: The biggest issue is time for planning with the co-facilitator and grading student work.

NT: I am an inclusion special education teacher. Although I have used PBL in the past when I had my own classroom, how well it is implemented now depends on the general education teacher who is in charge of the classes even though it is an all PBL school. Collaboration among adults has been one of the roadblocks.

NT: Old habits hinder.

NT: It is difficult to find adult/outside connections for our students.

NT: Residual culture.

Non-NT: I don't believe it to be the best approach for world languages, particularly in the beginning levels. As students are functioning at a toddler/preschooler vocabulary, they can't do PBL in meaningful ways to learn a language. Second language acquisition research says that students need to hear and read lots and lots of meaningful language that they understand before they are ready to produce, and that forced early production is detrimental.

Non-NT: My project was about Monarch caterpillars. Monarchs had a virus this year and there were very few to be found.

Non-NT: The Buck Institute's website has really helped with my implementation of PBL this year. I have downloaded most of the forms and we have referred to them often as a grade level. I have also referred back to the book many times!

Non-NT: We had a great entry event, and we got off to a great start. At the end, our community partner failed us and we did not complete the end of the project.

Non-NT: Community partners are difficult to find.

Factors that contributed to or lessened motivation. For the question about factors that impacted motivation, 98 NT teachers provided a response, and 88 Non-NT teachers provided a response, for a total of 186 responses (Table 31). Some respondents included more than one item in their response. For those responses that included more than one contributing or lessening factor, a separate item was created for each factor mentioned. The items were first categorized as either contributed to or lessening, and then by topic. If the respondent did not indicate whether the factor contributed to motivation or lessened it, the item was removed from the analysis. Factors determined to be unclear in meaning or irrelevant to the question were eliminated from the analysis. The remaining 187 items were assigned a topic code. Next, the items were sorted by topic code and tallied.

Inter-rater reliability was established using the same process described for the data related to factors that hindered or facilitated implementation. Thirty percent of the items (56) were randomly selected to be coded by a second rater who was trained in the coding scheme. Interrater reliability for the initial coding attempt was found to be .74 ($p < .01$). While this level of agreement may be interpreted as "substantial," (Landis & Koch, 1977), improvement was sought. The coded items and the codes were reviewed to identify causes of discrepancies. Insights gained from this review were applied to improve agreement. Several of the codes were determined to be too close to allow clear distinction, and therefore, were consolidated into a single code, resulting in 19 codes (Table 31). After recoding, the interrater reliability was found to be Kappa = .83 ($p <$

.01), a value that may be interpreted as "almost perfect agreement" (Landis & Koch, 1977).

Table 31

Factors that Contributed to or Lessened Motivation to Implement PBL

Topic	Category		
	Contributed to	Lessened	TOTAL
Perceived student issues (OE) • Abilities • Attitudes • Experience • Engagement • Behavior • Motivation • Self-regulated learning • Performance • Turnover/transience • Learning	30	26	56
Time (SC-SS) • Curriculum • Planning • School Schedule (calendar, time of year, events, classroom) • Implementation of a new evaluation system • Workload, multiple projects, multiple classes	0	51	51
Support or buy-in (SC-SS) • Teachers • Administration • District • Parents • Community	6	17	23
Believe in it (TV)	7	1	8

School wide emphasis (SC-SS)	4	3	7
Technology and Resources (SC-SS)	0	7	7
Standardized test scores or curriculum (SC-SS)	0	6	6
Collaboration (SC-T)	5	0	5
Enjoyment (TV)	4	0	4
Experience, practice, knowledge, training (Mentors, internships, professional development) (SE)	0	4	4
Teacher evaluation (SC-SS)	0	4	4
Team teaching (SC-T)	0	3	3
Community partners (SC-SS)	1	1	2
Class size (SC-SS)	0	1	1
Fear (SE)	0	1	1
Frustration	0	1	1
Meetings (SC-SS)	0	1	1
Save the program (SC-SS)	1	0	1
Student assessment (SC-SS)	0	1	1
TOTAL	58	128	186

As shown in the table above, of the 186 distinct items provided in response to the question, 58 items (31%) were reported as contributing to motivation, while 128 items (69%) were reported as lessening motivation. The factor most frequently reported affecting motivation was students (56, 30%). In 26 instances, students contributed to motivation, while in 30 instances, students lessened motivation. When students were

engaged and successful, teachers were more motivated; when students were absent, "pushed back," or displayed disruptive behaviors, teachers were less motivated. Example responses in this category are:

> Seeing continued student growth and excitement has contributed to my motivation to continue implementing PBL. This year I had three autistic students conversing with senior citizens about the importance of voting. The conversations were unprompted by a facilitator. The boys simply fell into the learning and natural environment of high expectations that surrounded them. In two hours, we were able to do what IEPs could not do in years.

> Working in a high poverty district where education is not valued in the community, the thought of having to teach solely through PBL is daunting. PBL requires students to be self-motivated and many of our students are not motivated in any way.

Time was the most frequently reported factor affecting motivation (51, 28%). In all 51 instances, lack of time was cited as a factor that lessened motivation. This category included insufficient time to plan, lack of classroom time to cover the curriculum, and not enough time to meet the high number of demands of being a teacher. Example responses in this category were:

> I think moving into my fifth year my motivation is starting to lessen due to the amount of work that is required to make really great projects. There is

SO much additional work and time commitment in a PBL classroom/school, and sometimes it is frustrating that others can simply make copies out of a text and be done while you are planning endlessly. Of course, I want my students to be motivated and involved in their learning, which is why I have continued in PBL, but it can be frustrating at times.

TESTING, TESTING, TESTING! Our middle school follows the acuity-based testing per quarter that leads to great success on the (state standardized test). Due to this, certain benchmarks must be met, standards covered, and acuity quizzes given every three weeks. This very much hinders and adds pressure to how much must be taught and when. Time is always a de-motivator in the classroom!

My schedule changes have lessened my motivation because I have less time to do twice as many things. The concept of PBL is still fairly new to me. I have yet to take the time necessary to completely put together PBL lessons. I have successfully put together a few, but we haven't yet made it that far into the spiral curriculum yet.

The third most frequently reported motivational factor was support (from administration, the district, parents, the community, or other teachers) (23, 12%).

Receiving support was identified as a factor that contributed to motivation (6), while lack of support was identified as lessening motivation (17). An example response included:

> I have a great advocate that gives me all the support I need whenever I need it. However, there are several teachers at my school that are not completely sold on the idea of PBL so it makes for a somewhat challenging environment. It would be nice if we were all on board.

The next most frequently cited factor affecting motivation was belief in PBL as important or effective for students (8, 4%). Seven teachers reported that their belief in PBL contributed to their motivation, while one teacher reported that their lack of belief in PBL lessened motivation. Example responses to this question are:

> Nothing has lessened my motivation to implement PBL. I can't imagine teaching any other way. There are times when I feel overwhelmed because I'm in my first year of teaching and also in the process of getting my Master's degree, but my students are incredibly engaged and even when I'm not as prepared as I'd like to be, I can still tell that they are learning important problem-solving and communication skills as well as enjoying my class.

"I believe in PBL. I am excited about the project that I created. I know the power and value children will benefit from being involved in PBL."

The total number of factors related to the SC-SS variable reported as contributing to or lessening PBL motivation was 104 (56%). The number of factors reported relating to the SC-T variable was 8 (4%). The number of motivational factors reported related to

SE was 5 (3%). The number relating to OE was 56 (30%). The number of factors related to the task value variable (TV) was 12 (6%).

A sample of responses from the three categories most frequently referenced as impacting motivation is provided in Table 32, along with several other responses that were not in the top three categories. The responses are grouped by category. Each response is identified as being provided by either a NT teacher or non-NT teacher.

Table 32

Sample Factors Reported as Impacting Motivation

Students
NT: The students are more engaged through PBL than my experiences in the past.
NT: The student growth I have seen has increased my motivation for PBL.
NT: When students are getting off-task and they are not motivated or excited about learning, I feel as if I am just wasting their time.
NT: The kids have a difficult time staying on track and sometimes it is difficult to ensure that they are learning and doing what they are supposed to be learning and doing.
NT: Seeing student engagement sore has definitely been a plus for me.
NT: Most students have been enthused by the projects we have introduced. This has motivated me. Sometimes the students are not very interested in the scaffolding activities that we have planned to help them get ready for the final product. Their resistance has lessened my motivation.
NT: I have seen students who were on the brink of being kicked out of school turn themselves around and actually enjoy school. That has been the most rewarding for me.
Non-NT: Working in a high poverty district where education is not valued in the community, the thought of having to teach solely through PBL is daunting. PBL requires students to be self-motivated and many of our students are not motivated in any way.
Non-NT: Seeing continued student growth and excitement has contributed to my motivation to continue implementing PBL. This year I had three autistic students conversing with

senior citizens about the importance of voting. The conversations were unprompted by a facilitator. The boys simply fell into the learning and natural environment of high expectations that surrounded them. In two hours, we were able to do what IEPs could not do in years.

Non-NT: Complaints from students that they are not being taught have lessened my motivation to implement PBL. Seeing students understand things they never have before through hands on projects that are relevant to their lives contributes to my motivation daily and outweighs any negatives there may be to this model.

Non-NT: I felt my non-honors pre-cal students last year learned very little when being taught in the traditional chalk and talk format. This year I feel they are much more engaged. While the depth of theoretical understanding is not there as much, I feel they are getting more out of it and seeing more of the practical application of the math.

Non-NT: The buy-in during project roll-outs and several excellent final products have contributed to my motivation. My students' poor standardized test scores and lack of personal responsibility have lessened my motivation.

Non-NT: The students have done better than expected with the peer-driven activities.

Non-NT: I think the biggest factor in motivating me to implement PBL has been the kids' excitement. Our principal challenged us to plant a colorful garden to make our school more welcoming and the kids have taken this challenge VERY seriously. My kindergarten students have researched plant zones, kinds of plants, when they bloom, how tall they grow, etc. We have learned from a landscape architect, who actually took the best elements of our designs and made them into a professional one. The kids have been beyond excited to see their ideas come to life. We have already planted the bulk of our garden, so the kids can see every day how THEY CAN MAKE GOOD THINGS HAPPEN!!!

Time

NT: The planning takes an enormous of time. It has not hindered me, but I do get very tired when it comes to creating all the documents, planning the unit, and evaluating—beyond the everyday classroom activities.

NT: Making new projects is exciting. Not having enough time to fully prepare projects lessens overall motivation.

NT: Time to plan and grade are the biggest factors that have lessened my motivation.

NT: The lack of planning time with my cohort is detrimental to the overall implementation.

NT: The struggle, for me, is learning how to get everything in. There were some really successful things that worked before we were PBL, but it's hard to fit them in to projects especially in an integrated class (English/Social Studies) because they might not fit w/ the social studies part. So, i find that I struggle with the balancing act.

Non-NT: Would like to use it more extensively. Lack of time has been a problem.

Non-NT: It has been hard to implement PBL because we adopted hands-on science kits that have the year pretty strictly mapped out so it is hard to find time for PBL.

Non-NT: There are many topics throughout the year that lend themselves to PBL research activities. Unfortunately, being on such a rigid schedule makes it difficult for this to be a meaningful experience for students. I can only allow 30 minutes a couple times a week.

Non-NT: Amount of time needed versus getting through all the state standards.

Non-NT: I have seen it work in other classrooms, which has increased my motivation. It's my first year, so sometimes it's hard to want to put in the extra work to get the projects ready, but it's been worth it.

Support

NT: Factors that have contributed are co-workers support and a great director who has a lot of knowledge regarding PBL and how to implement it!

NT: My school is 100% behind PBL and we have been well trained by the New Tech Network.

NT: Working with someone who is not completely sold on PBL makes it more difficult to be motivated to implement the concepts.

NT: Support of the administration has contributed to my motivation to implement PBL as well as the achievement of students with disabilities, which I perceive to be greater in the PBL environment.

NT: The district put the program in our school, but has completely abandoned it.

NT: My motivation has been lessened because our administration has taken me away from the PBL model and placed me in a more traditional setting. This happened after I experienced much success last year in mostly PBL.

NT: Parent concerns and negativity (pushback).

Non-NT: Factors that have contributed to my motivation to implement PBL: Support from colleagues and administrators and h highly motivated colleagues and administrators who also want to implement PBL effectively.

Non-NT: Contributed: Willing experts from community.

Non-NT: Having community partner issues lessened my motivation.

Non-NT: Push back from students and parents.

Non-NT: I have a great advocate that gives me all the support I need whenever I need it. However, there are several teachers at my school that are not completely sold on the idea of

PBL so it makes for a somewhat challenging environment. It would be nice if we were all "on board."

Non-NT: It helped our school a lot that we are starting a new school that is wall-to-wall PBL. I think this would have been harder if just a few people in the building were trying to implement this on their own.

Non-NT: Lack of administrative encouragement and a grade-level project that only I seemed interested in completing.

Other

NT: I have had fun thinking up projects and working with my co-teacher.

NT: My motivation is unwavering. I know this works, and when things don't go well, it is almost always a result of accidentally straying from the model.

NT: I do struggle with the technology but have slowly been able to implement it in my class projects.

NT: The authenticity to real life is the most motivating factor for me. My worry is that student grades have all gone up even though their content grades are right about what I would get in science for a traditional setting. But on the report card their overall grade will reflect science. I realize that we do need to assess 21st century skills weekly but it could be masking their true deficiencies in science. That is a big concern.

NT: Our team all chose to be in New Tech and we all dove in. This means that not doing it is not an option.

NT: My schedule changes have lessened my motivation because I have less time to do twice as many things. The concept of PBL is still fairly new to me. I have yet to take the time necessary to completely put together PBL lessons. I have successfully put together a few, but we haven't yet made it that far into the spiral curriculum yet.

NT: Lessened by a less than enthusiastic team teacher, motivated by other PBL teachers, watching students learn, and an extremely supportive administration.

NT: My team members consist of a teacher who has experience but no PBL training and a first year teacher who has had PBL training but no teaching experience...it has made planning frustrating.

NT: Frustrations, time constraints, lack of student drive. Seeing students succeed definitely keeps me pushing forward and wanting to implement PBL.

Non-NT: My motivation keeps getting greater.

Non-NT: The project I implemented went very smoothly, but after everything was said and done, my students did not learn the material.

Non-NT: Student energy is up, but the tech issues outweigh the vibe.

Non-NT: My motivation has been lessened by other initiatives taking place in the school. Recognition that current methods are working based upon the state's new system for grading schools. I am not in favor of school wide approaches to learning. Education is not a one-size-fits all system.

Non-NT: My district is facing extremely difficult financial times, which makes our work environments especially trying this year. The difficulties motivate me to implement PBL so that the program will continue to receive support. But the financial issues themselves can often lessen motivation as well.

Non-NT: I like the teamwork and real-world aspect of PBL and that motivates me to use at least certain aspects of it.

Non-NT: Fear has played a part in implementation. It requires more traditional teachers to take risks, and that is something with which I'm not comfortable. At times I feel like I'm a new teacher all over again...and that is disconcerting.

Non-NT: Nothing has lessened my motivation to implement. I am eager to try again and just learn from what went wrong with this project and project idea.

Non-NT: We are all trying to figure it out. I do know that other teachers in my building were able to complete their projects, though...so maybe it is just me. I know that when I heard they were working on something it would get me excited again. Maybe we should have checked up on each other a little more.

Summary of Results

In this section, data were presented in response to each of the research questions. These data provide some information about the differences between NT and Non-NT teachers on measures of motivation, perceptions of school conditions, and implementation activities; the role of motivational beliefs, perceptions of school conditions, and level of PBL experience in PBL implementation; how those teachers' motivational beliefs, perceptions of school conditions, and intent to implement change as they begin working with PBL; and factors that teachers reported as impacting their

implementation and motivation. These results, implications for practice, limitations of the study, and recommendations for future research will be discussed in the next section.

5. Discussion

A growing number of schools are adopting PBL as a mechanism for fostering deep student learning and an opportunity for students to develop 21st Century skills. However, implementation of this student-centered, inquiry-based pedagogy is dependent upon significant changes in both student and teacher classroom practices. Such change is complex and requires new knowledge, as well as sustained time, energy, and effort at the classroom and school levels. Some studies of the implementation of educational innovation efforts have provided evidence that teachers' motivation plays a role in commitment to change (Abrami, et al., 2004; Tschannen-Moran & McMaster, 2009; Wu, et al., 2008;), others have highlighted the importance of school support and appropriate organizational structures in PBL implementation (Bradley-Levine, et al., 2010; Ravitz, 2008). The current study examined the role of both teacher motivation (including self-efficacy, outcome expectancy, and task value) and school-level features in the extent of newly prepared teachers' PBL implementation. Overall, the data indicate that for this sample, motivation played a significant role in implementation, but practical constraints were more important. Further, task value was the only significant motivational belief that played a significant role. Issues related to student motivation and performance were also very important. This section provides a summary and analysis of the results as they relate to relevant literature and insights gained from interviews about the "why" behind the

findings, along with discussion of implications for practice, limitations of the study, and recommendations for future research.

Research Question 1

Research Question 1: How do newly prepared PBL teachers in New Tech Network schools compare with those in non-New Tech Network schools in self-efficacy, outcome expectancy, task value, perceptions of school conditions, and extent of PBL implementation?

The purpose of this question was to compare the PBL experience, motivational beliefs, perceptions of school conditions, and extent of PBL implementation of teachers who work in two different contexts. This is an important comparison, given that school culture and school environment have been found to play a significant role in teacher motivation and classroom practices (Ford, 1992; Fullan, 2001; Hall & Hord, 2001; Lam, Cheng & Choy, 2010; Lepper & Hodell, 1989). Not only are NT teachers required to commit to fully adopting PBL as their primary teaching method, but also, their schools are equipped with wireless Internet access, one-to-one student laptops, and physical spaces designed for collaborative learning. Additionally, NT schools have flexible class scheduling, shared teaching resources, and ongoing training and coaching (New Tech Network, 2012). Because of these affordances, which have been identified as important supports for PBL (Bradley-Levine, et al., 2010; Ravitz, 2010), it was expected that NT teachers would report significantly higher levels of PBL implementation and perceptions of school conditions than non-NT teachers. Also, due to prior research on the impact of

school culture and environment, it was anticipated that the NT teachers would have higher measures of motivational beliefs.

The independent *t* test revealed significant differences between the two groups on four of six measures. The largest effect was on the measure of perceptions of school conditions-school structures, followed by the extent of PBL implementation, perceptions of school conditions-teacher participation, and task value. There were no significant differences between the groups on measures of self-efficacy or outcome expectancy.

Perceptions of school conditions-school structures. The largest effect between NT and non-NT teachers on Time 2 was on the school conditions-school structures measure. This variable was derived from items related to school policies and organizational structures that have been found to be important in PBL initiatives (Bradley-Levine, 2010; English, 2011; Ravitz, 2010). These items are: A school-wide emphasis on PBL or inquiry learning, block or flexible scheduling, flexible curriculum to support PBL, school wide rubrics, PBL grading policy alignment, collaborative project planning and assessment system, adequate student access to technology, and adequate teacher planning time. By design, NT schools have most or all of these features in place, which explains at least some of the differences in reported perceptions. However, as reported by teachers, there were 23 non-NT schools represented in the study that had a school wide emphasis "frequently" or "always." Those schools may have also been designed to have most or all of these PBL-supportive school policies and organizational structures in place as well; however, the philosophies, missions, and models of those schools were not investigated.

One unique feature of NT schools is a web-based, collaborative learning environment called ECHO, which provides a centralized platform for students, teachers, and parents to communicate and share information and resources (New Tech Network, 2013). Students are also provided with laptops and other electronic devices. A teacher with 20 years of classroom experience, now in her first year at a NT school, is finding that she has the resources she needs to do learning activities that she was not able to do previously (interview):

> In traditional classrooms, you're sorta boxed into the traditional way of doing things because you don't have resources or support. Now I can do things in the classroom that I had really wanted to do but didn't do before. For example I'm taking a group of kids to the river to take water samples and we're going to test for pollution. That's something I wanted to do in the traditional classroom, but I had a lot more kids to take and I didn't have much support in terms of them paying for the water kits and things like that. The kids also have iPads, which makes it a whole lot nicer too. They're going to film the river and they're going to make PSAs about the pollution in the river. We have equipment and time and support to do things that I had wanted to do for a long time.

However, the technology in NT schools was not without problems. Network issues, broken laptops, outdated computers and software were identified by some teachers as factors that hindered their implementation. In at least one case, as a NT interviewee explained, this was due to a lack of funding from the district.

While technology and some of the other more concrete affordances of NT schools have clear advantages for PBL, the benefits of a school wide emphasis are less defined. Some interviewees identified a common goal or mission, common norms and practices, clear expectations, as well as accelerated learning for teachers as benefits of a school wide emphasis—all of which can serve to unite teachers. One NT teacher described the commitment she observed among teachers at the summer conference (interview):

> We had a great time (at the training). You could see the different personality types, but everybody had a similar theme—we want to make this work, we think this is really cool, and we are willing to do whatever we need to do help each other, to make it work for our own classes. We were already dedicated to making it succeed.

Others explained the benefits of a school wide emphasis for students. According to these teachers, when a student encounters the same expectations, language, and practices across grades and across classes, certain intellectual habits and ways of learning become an ingrained part of the classroom norms, making the learning process smoother. A school wide emphasis also brings with it resources and support—that is—support of administrators, colleagues, parents, and other community members.

Extent of PBL implementation. The next largest difference between NT and non-NT teachers was on the extent of PBL implementation. While 77% of non-NT teachers reported implementing one or more projects, 85% of NT teachers achieved this extent of implementation. While only 11% of non-NT teachers reported fully adopting PBL, 67% of NT teachers did so. The disparity between the two groups on this finding

was not surprising, given the NT schools' requirement for teachers to commit to PBL as their primary method of teaching. A teacher at a school in its first year with NT explained how her school's current PBL efforts contrast with their pre-NT efforts:

> The school where I currently teach has supposedly always been a PBL school, so we have tried implementing it before, but it's something that has kind of been ebbing and flowing according to what's going on. I would say it was kind of sketchy…there wasn't much of an expectation or it wasn't well-defined, so it was kind of hit or miss.

This interview comment highlights the impact of clear expectations and a well-defined model of PBL. The school plans to have wall-to-wall PBL in place by 2015.

It was surprising that the percentage of NT teachers fully adopting was not higher, given the stated requirement for teacher commitment to PBL. Through interviews, two reasons for this were discovered: 1) Some of the NT schools involved in this study were in the early stages of a phased approach to school wide implementation and as such, not all teachers in those schools were required to teach with PBL; 2) At least one school was "regressing" (as the teacher referred to it) away from the NT model due to a loss of district funding as well as state mandates imposed due to the school's failure to meet the minimum school performance score.

Perceptions of school conditions-teacher participation. The next largest effect between NT and Non-NT teachers was on the perceptions of school conditions-teacher participation variable, which is comprised of items associated with teacher leadership and collaboration in support of PBL. Those items are: have instructional coaches and/or

"critical friends" visits, be involved in school leadership, participate in high quality professional development, and collaborate with colleagues to plan and discuss issues. These and similar features were found in previous studies to be supportive of PBL (Bradley-Levine, et al., 2010; English, 2011; Lam, et al., 2010; Ravitz, 2008). The difference between the NT teachers and non-NT teachers on this measure may be explained by NT's school culture, which emphasizes support for team teaching and cross-curricular projects, ongoing professional development, and personalized coaching (New Tech Network, 2012). A NT interviewee describes how the supportive culture helps her:

> It's a huge daunting thing. If I were all alone, I'm sure I would be belly up in the water right now, if I didn't have the support. Because I get help from every direction it makes it like I'm not alone, I can do this, they're all feeling the same stress that I am and we just kind of hold each other up.

This quote elucidates how a supportive environment can boost morale and strengthen the will to persist through challenges. Some of the non-NT schools also had a school wide emphasis. Another advantage of such an environment described by a non-NT teacher is the accelerated teacher learning that is made possible: "Being a part of a PBL school has helped me build my knowledge of PBL instruction."

Task value. The last measure that was significantly different between NT and non-NT teachers was task value. On Time 2, the means of each of the eight task value items were significantly higher for NT teachers. Given these results, the NT teachers who participated in this study clearly perceived PBL to have a high level of functional utility for both students and for themselves. There is no evidence that this difference is related to

the demographic characteristics, such as years of teaching experience, academic subject taught, or learning preference, since the sample was similar to non-NT teachers on these variables. There was a significant difference between NT and Non-NT on the distribution of teachers across elementary, middle, and high schools, however. A comparison of means across school levels revealed no significant differences on any of the motivational measures, including task value. This provides evidence that NT's higher task value measures were not related to the relatively large portion of high schools in the NT sample (80%). There was also no significant difference between NT and non-NT teachers on the PBL experience measure.

The task value item with the largest mean difference between NT and non-NT was "Is it important to your career to be successful in teaching with PBL?" The large difference on this item can be explained by NT's emphasis on PBL. It follows logically that teachers in schools that are committed to full implementation of would believe that being successful with PBL is important to their career.

New Tech teachers had significantly higher measures of task value not only on Time 2, but also on Time 1, which was conducted before the school year began. This indicates that NT teachers already had a relatively high level of value for PBL when prior to their initial implementation efforts. There is no one path that landed the NT teachers in their current schools, as gleaned from interviews. Some of the NT teachers were already at their current school before it became a NT school, and chose to stay. A high school English teacher applied for a job at a NT high school because she feared losing her job at her previous school as a result of "shuffling" of schools and personnel within the district.

She did not get the job on the first attempt, but was hired when she re-applied a year later. In a third example, a first year teacher who did not know much about PBL before this school year, explained that he was matched with his NT school through the Teach for America program's placement process. In a fourth case, a teacher with 20 years of experience shared that she decided to apply at a NT school after being exposed to PBL through training and then talking with a friend who is a NT teacher (interview):

> I took some training at the beginning of the year last year and I thought it was great, and I have a friend who teaches at a NT school so I questioned her about it. I love it, so I thought maybe I'd give it a try. So, I kind of put my name in the hat and they were expanding (this is the third year), so I knew there was an opportunity to get in, and I went ahead and decided to give it a try.

In each case, the teachers were aware, in advance, of the PBL focus of the schools where they landed, and decided to teach there. NT interviewees described the characteristics that they believe are associated with teachers who adopt PBL, including flexibility, willingness to try new things, openness to technology, and willingness to learn on an ongoing basis. A teacher who was hired into a NT school this year shared that during her job interview, the principal focused his questions on such traits. Interview questions included: "How well do you play with others on the playground? How do you build a rapport with your students? What do you think of change and how willing are you to try new things?" This teacher's experience suggests the principal was focused on hiring teachers with strong relational skills and willingness to learn—characteristics that are important for collaboration and change.

On the survey and in interviews, NT and non-NT teachers reported similar reasons for liking PBL; they believe in it as the best way to teach their students, they enjoy seeing the students learn new skills and become more responsible, and they enjoy seeing students' enthusiasm and excitement for learning. One NT teacher expressed her motivation for implementing PBL this way: "I have seen students who were on the brink of being kicked out of school turn themselves around and actually enjoy school. That has been the most rewarding for me." Similarly, a non-NT teacher reported, "I think the biggest factor in motivating me to implement PBL has been the kids' excitement."

It is interesting to note that despite the NT requirement for PBL commitment, only 46% of NT teachers indicated "school requirement or expectation" as their primary reason for planning to teach with PBL. A significant portion of them indicated "to help students" as their primary reason for planning to teach with PBL. One interviewee said he likes the autonomy that PBL affords him, and another shared that he likes the creativity, and being able to express himself as he creates videos and other product examples for the students.

Another possible explanation for the higher levels of task value in NT schools may be the more PBL-conducive conditions in NT schools. The correlational analysis revealed a significant positive correlation between the perceptions of school conditions measure and task value. Although the task value measure decreased by four percent between Time 1 and Time 2, this was much less than the change for non-NT teachers (nine percent). Further, a Survey 2 open-ended question asked, "What factors have contributed to or lessened your motivation to implement PBL so far this semester?" In

response to this question, many school-level factors were reported, such as workload, planning time, teamwork and collaboration, and availability of technology and other resources. When conditions were favorable, these factors were reported as *contributing* to motivation; when conditions were unfavorable, the factors were identified as *lessening* motivation. Therefore, in NT schools, where these conditions were found to be, on a whole, more favorable, it is not surprising to find higher levels of motivation. Additional research is needed to learn more about the relationship between perceptions of school conditions and task value.

There was no significant difference between NT and non-NT teachers on the measures of self-efficacy and outcome expectancy. This was true for both Time 1 and Time 2. The self-efficacy measure is context-specific and was designed to measure teachers' beliefs about their capability to perform PBL-related tasks. Given the similarity in the two groups on demographic characteristics and the amount and type of introductory training they had received, it makes sense that they would report similar levels of self-efficacy on Time 1. The change in self-efficacy during the first two months of implementation was similar for NT and non-NT teachers, which explains why there was again no significant difference in self-efficacy between the two groups on Time 2. The four primary sources of self-efficacy, according to Bandura, include verbal feedback from others, observations of peers successfully performing the task, mastery experiences, and the emotional arousal experienced as the task is anticipated (1997). It is reasonable to assume that the two months between measures was not enough time and input from these four sources to create changes in self-efficacy.

Similarly, since most teachers reported themselves to be beginners with PBL, and most had little to no PBL experience, the outcome expectancy measure from Survey 1 data was based on pre-conceived notions of how students would perform in PBL, based on experiences of teaching with other methods. Since there is no evidence to suggest that the two groups of teachers would have had different experiences with students in previous experiences, there is no reason to have expected the outcome expectancy measure to differ. Further, the lack of significant difference between the groups on Time 2 signals that the teachers were having similar experiences, or perceptions of experiences, during the first two months of implementation. Over time, it would be expected that teachers in NT schools, or in other schools with a school wide emphasis, to have greater outcome expectancies than other schools, as students in those schools would be expected to gain practice and skill as learners in PBL more quickly than others.

Research Question 2

Research Question 2: What is the role of newly prepared PBL teachers' motivational beliefs, perceptions of school conditions, and PBL experience in the extent of their PBL implementation?

This question was answered with a hierarchical multiple linear regression analysis. Variables included in the analysis were selected because they are positively correlated with extent of implementation. After controlling for the variable, New Tech versus non-New Tech, each of the models under analysis played some role in the extent of teachers' PBL implementation. In the fourth model, which was inclusive of all

variables of interest, perceptions of school conditions-school structures played the largest role in implementation, followed by PBL experience, and then task value.

Perceptions of school conditions-school structures. While measures of motivational beliefs were relatively high, they accounted for less variance in extent of implementation than school conditions-school structures. This means that teachers pointed to practical considerations (which, in this study, included such factors as access to technology, time for planning, curriculum flexibility, and class scheduling flexibility) as constraints to their PBL implementation, even though the motivation was relatively high. The important role that perceptions of school conditions played in the implementation of PBL in this study is aligned with findings from previous research on school change and PBL implementation. For example, based on extensive research of school change, Hall and Hord (2001) concluded that features such as facilities, resources, policies, structures, and schedules play a significant role in shaping change. In their 2010 study of motivation, perceived school support, and attitude for future persistence of PBL, Lam, et al. found that perceived school support had both direct and indirect effects on teacher willingness to continue with PBL. In the current study, time and student-related issues were the factors most frequently reported as impacting implementation and motivation. These findings resemble those of Bradley-Levine, et al. (2010) and Ravitz (2010). Specific details of the specific school conditions that teachers found to be important, and what teachers said about them, are provided in the discussion for Research Question 4, regarding factors that impacted imlementation and motivation.

It is important to note that school conditions may not be perceived in the same way by everyone. For example, for non-NT teachers, negative correlations were identified between school conditions-school structures and years of teaching experience (r = -41, p, < .01), as well as school conditions-teacher participation and years of teaching experience (r = -.29, p < .01).

PBL experience. The regression results indicated PBL experience also had a significant role in extent of implementation. The PBL experience variable is composed of four items related to amount and type of exposure to PBL: 1) Extent of study of PBL during pre-service education, 2) amount of exposure to PBL as a learner, 3) amount of time teaching in PBL, and 4) number of hours of PBL professional development. While most of the participants in this study identified themselves as beginners with PBL, there was a range of education, training, and hands-on experience based on the four items. This experience was found to be positively associated not only with implementation, but also with all three measures of motivations and the measure of perceptions of school conditions-teacher participation. Specfically, an independent samples t test that compared participants with relatively low PBL experience and relatively high PBL experience revealed significant differences (in order from largest effect to smallest) in self-efficacy, extent of implementation, task value, outcome expectancy, and school conditions-teacher participation. This finding aligns with the literature, which makes the case that implementation of educational innovations is a process, rather than an event (ACOT, 1996; Hall & Hord, 2001; Hall & Loucks; 1977). Specific to PBL, Ladewski, et al., found

that new project based science teachers go through repeated cycles of enactment, collaboration, and reflection (1994).

Those with higher levels of PBL experience also had higher measures on each of these variables, including extent of implementation. Research provides support for the theory that mastery experiences (successful application) can increase self-efficacy, which in turn, can contribute to teacher implementation of innovations (Tschannen-Moran & McMaster, 2009). Interviews with participants of the current study shed light on this process. A NT high school teacher with 14 years of classroom experience has experienced some of this already, in his first few months of teaching with PBL. As this quote explains, student and teacher experience in PBL can lead to efficiencies and effectiveness in teaching, as well as improved student performance. Improved student performance, in turn, can benefit teachers (interview):

> Once you get past how much work it is up front, you'll see that the time you spend and your classroom experiences are way enjoyable. Once you train students how to think and you know how to give them a 21st Century culture, it really becomes easy. My partner and I are teaching algebra and science together and we are just working on our planning and scaffolding for future projects and we're flying through it now. It was intimidating at first, but we've learned ways to manage time better.

For some, having in-depth instruction about PBL and other inquiry-based approaches during pre-service education also shaped their motivational beliefs in regard to PBL. A non-NT middle school science teacher with 25 years of classroom experience,

who has been using student-centered practices throughout her career, explained that her pre-service education program (completed in the 1980's) emphasized various pedagogical approaches based on constructivist theory, including discovery learning, problem-based learning, and inquiry-based learning. She and other students in the program analyzed various approaches to teaching and learning through class discussions, research, and interviews with children to determine what they felt worked. This experience left a lasting impression on her (interview):

> It was unbelievably beneficial to talk to the kids because the kids we were not a real authority figure and they could really tell us what they thought. It left such an impression on me because they would say things like 'Oh my gosh, taking notes is so boring. I hate taking notes, I hate sitting still. How come we don't do science outside? And I thought to myself, you know, that's a great question; what don't we do that? So at that point, I made up my mind that if I got into a school that accepted inquiry-based learning, that was what I was going to do.

These interview data provide some explanation of how PBL education, training, and experience may work to further PBL implementation and improve motivational beliefs. Increased efficiency and effectiveness, improved student performance, and powerful educational experiences are factors that motivated and enabled PBL implementation for some of the teachers interviewed.

The increase in self-efficacy can be explained by the postitive effect of mastery experiences (Tschannen-Moran & McMaster, 2009). Given the correlations among the

motivational variables and the qualitative data about the importance of student motivation and performance, mastery experiences may play a role in outcome expectancy and task value. The fact that motivation changed significantly with experience and perceptions of school structures did not change significantly indicates that perceptions of school conditions may play a larger role in implementation for those with less PBL experience.

Task value. Of the three motivational variables entered into the regression model, task value was the only one that played a significant role in extent of implementation. In previous studies as well, task value has been found to play a significant role in teachers' intention to implement an innovation. For example, the 2008 study of teachers' intention to infuse instructional technology into their teaching practices found that perceived usefulness (which resembles the perceived functional value of the task-value model) had the highest level of influence on intention to infuse (Wu, et al., 2008).

The task value variable in the current study was comprised of questions related to enjoyment and satisfaction, perceived utility, and perceived costs-to-rewards of PBL. The only individual items from the three motivational scales that were equal to or greater than 90 were task value items. Further, the fourth most frequently cited factor affecting teacher motivation was belief in PBL as important or effective for students (8, 4%), which relates to the functional utility component of task value. Seven teachers reported that their belief in PBL contributed to their motivation, while one teacher reported that their lack of belief in PBL lessened motivation. In interviews, when teachers who reported that they liked PBL were asked what they like about it, several different reasons were typically given: they believe in PBL as the best way to teach their students, they

like the autonomy it provides them as a teacher, they like the creative process, they enjoy seeing the students learn new skills and become more responsible, and they enjoy seeing students' enthusiasm and excitement for learning. Seeing students succeed seemed to be a substantial source of task value. In an interview, a first year teacher who is currently the only teacher in his high school teaching with PBL explained that he enjoys teaching more when his students are enjoying learning (non-NT):

> I can tell the students enjoy PBL more than doing book work. I have no interest in being a teacher just to share knowledge. I'd rather put them in a situation where they can make some decisions on their own, where what they're doing is a little more relevant. I'm aware that there are certain things they're going to have to do that they don't want to do, but for the most part, if they're not happy, it's going to be really hard for me to be happy, so I guess that's why I enjoy it.

By the same token, when teachers perceived student participation and outcomes as inadequate, teachers reported that their PBL motivation was lessened. Examples of challenges related to students include lack of student buy-in, motivation, and self-regulated learning, along with poor attendance, high levels of transience, and low levels of academic performance.

Another source of task value is whether teachers' perceived benefits of PBL are worth the perceived personal costs. One non-NT high school math teacher who was interviewed explained that while he likes the authenticity of the learning in PBL, he finds PBL to be more effective for more academically successful students than others, and that

PBL works better for some math subjects than for others. Given that PBL takes more of his time, he decides whether to use a PBL approach or a "chalk and talk" approach based on the anticipated gain: "There is not enough time in the day and I'm not going to spend three hours extra at the school every day designing projects because essentially if I don't feel that there's a huge gain out of it."

Another factor may be related to task value is years of teaching experience. For non-NT teachers, the correlational analysis revealed a low negative correlation between task value and years of teaching experience for non-NT teachers ($r = -.24$, $p < .05$), indicating that those with more experience value PBL less and find it less enjoyable. Several interviewees with a relatively high number of years of teaching experience described that they went through a process of letting go or "warming up," as one 13-year veteran explained (NT, interview):

> I did not like it right off the bat. I had to warm up to it. I was more of a traditional teacher who liked having control of my classroom. But PBL is totally different. The kids are allowed to just get up and walk around, explore, and talk to other kids. That just didn't sit well with me in the beginning, but I kinda wandered through it eventually.

Outcome expectancy. According to the regression, outcome expectancy did not play a significant role in extent of implementation. According to the theory, expected outcomes influence one's decision of how and where to exert efforts and focus energies (Bandura, 1986). However, Bandura (1997) explains that outcome expectancy is only predictive of behavior when the subject believes that the outcomes are a result of their

performance; if they believe the outcomes are beyond their control, apathy results. The fact that outcome expectancy did not play a role in extent of implementation as determined by the regression may be an indicator that participants of the current study do not attribute student engagement and performance as being a result of their own teaching performance. However, because teachers frequently cited student performance and engagement as impacting their motivation, outcome expectancy may have served as a source of task value. Further exploration into the relationship between outcome expectancy and task value, specifically in PBL, would be valuable. Additionally, it would be useful to analyze newly prepared PBL teachers' attributions in regard to their students' engagement and performance.

Self-efficacy. Self-efficacy also did not play a significant role in extent of implementation in the current study. This is counter to the findings of other studies that have found self-efficacy to be a significant predictor in the implementation of educational innovations (Curts, Tanguma & Peña, 2008; Lumpe & Chambers, 2001; Pan & Franklin, 2011). One possible reason for this discrepancy is the complexity of measuring self-efficacy, as noted by Tschannen-Moran and McMaster (2009). The authors have found that measures of self-efficacy tend to fluctuate during the early stages of planning and implementation, when teachers have insufficient experience to gauge challenges realistically, and therefore, early successes and failures can cause large gains and drops in self-efficacy, making this measure an unreliable predictor (2009). The overall mean self-efficacy of current study participants did not change significantly between Time 1 and Time 2. The mean Time 2 was 82, suggesting that these teachers were fairly certain of

their capability to perform PBL-related tasks, such as creating a driving question, creating rubrics, and teaching students self-regulated learning skills. It is unclear as to whether lower levels of self-efficacy would be more predictive of extent of implementation. This is something that would be useful to examine in future research.

Research Question 3

Research Question 3: How do newly prepared teachers' motivational beliefs, perceptions of school conditions, and intention to implement PBL reported immediately after PBL training compare with their motivational beliefs, perceptions of school conditions and extent of implementation during the first two months of school following the PBL training?

To determine how motivational beliefs, perceptions, and plans changed, a paired samples *t* test was conducted comparing data collected immediately following summer professional development (Time 1) and data collected during the third month of implementation in the semester following summer professional development (Time 2). For most participants, the data reported before the semester began were based on teachers' projections of what the experience might be like, while the measure during the semester was based on actual experience. Five of the six measures decreased significantly between Time 1 and Time 2. The largest effect was seen between the intent to implement PBL and the actual extent of implementation, followed by perceptions of school conditions-school structures, task value, perceptions of school conditions-teacher participation, and outcome expectancy. There was no significant change in self-efficacy.

Intent to implement vs. actual implementation. The largest decrease was between the measure of intent to implement and extent of implementation (8% change for non-NT and 18% change for non-NT). Research has shown that the act of transforming classroom practices is a complex process that takes time and is subject to a number of personal and contextual factors (Fullan, 2001; Hall & Hord, 2001). Identifying factors that influenced PBL implementation is the central focus of the current study.

As reported on Survey 2, 29 of 186 teachers (16%) did not implement any PBL projects. In response to the open-ended survey question about what factors had hindered or facilitated PBL implementation so far in the semester, the factors that teachers most frequently reported as hindering implementation (in order from most frequently reported to least frequently reported) were lack of time, perceived student issues, lack of support, and lack of technology and other resources. The same factors were reported as lessening motivation as well. These data provide some explanation of why the extent of implementation was lower than the intent to implement.

Interviewees offered other perspectives on why some teachers may be hesitant to implement PBL initially, such as "residual culture" or "old habits." A 25th year middle school science teacher, who is a lead PBL teacher in a non-NT school, points to fears that result from accountability: "I think a lot of teachers are really caught. They don't have the supportive administrators and they are under pressure to teach to the test, so I think it is fear." A 13-year veteran (in a first-year NT implementation effort) explained that in her school, those who are eager to learn and commit to PBL are referred to as "believers," while those who demonstrate reluctance are referred to as "resisters." From this teacher's

observations, the choice to change classroom practices or not is dependent upon several factors:

> It's probably about core beliefs about what they think is best for their students. And a lot of people have confidence in how they teach already. And then another type of resister is the type that does not believe PBL fits with their curriculum.

Several interviewees described a process of change that often occurs for those who might be viewed as "resisters." Reportedly, pressure and encouragement to change comes from various directions, including administrators, other teachers, and often, from students who are engaged and enjoying learning through PBL. When interviewees were asked what advice they would give administrators to get reluctant teachers on board, they suggested that in addition to equipping them with knowledge and information about PBL, they should be given understanding, patience, leadership by example, and ample time for adjustment.

Perceptions of school conditions-school structures. The perceptions of school conditions-school structures measure also decreased significantly between Time 1 and Time 2. This means that the practical affordances for PBL implementation were not as favorable as teachers had expected. For NT teachers, there was a seven percent decrease, while for non-NT teachers, there was a 16% decrease. Specific items in this variable were a school-wide emphasis on PBL or inquiry learning, block or flexible scheduling, flexible curriculum to support PBL, school wide rubrics, PBL grading policy alignment, collaborative project planning and assessment system, adequate student access to technology, and adequate teacher planning time. In the open-ended survey question about

what hindered or facilitated implementation, a number of these items were specifically mentioned as hindering implementation, including inadequate planning time, inadequate classroom time, insufficient technology access, and a curriculum and an assessment system that are perceived to be disconnected from the skills that students learn through PBL. Based on the frequency with which these items were cited as hindering implementation, it is assumed that these were the practical constraints of greatest concern for the participants of this study.

An additional factor related to school structures that was not one of the multiple choice items, but was identified as a hindering factor in implementation, is community partners. In support of PBL projects, community members often provide project resources, subject matter expertise and context for an authentic, local problem upon which to base the project. Seven teachers (4%) reported that challenges related to community partners hindered implementation. Specific challenges included difficulties finding appropriate and willing community partners and lack of follow-through by community partners. The role of community partners in PBL and the mechanisms for gaining their support and buy-in are important considerations for educators who want to implement PBL.

Task value. Task value was one of the two motivational beliefs that decreased significantly between Time 1 and Time 2. There was a 4% decrease for NT teachers and a 9% change for non-NT. This variable, which is designed to assess the level of value that teachers place on PBL, is composed of three components: enjoyment or intrinsic rewards, utility or functional value, and personal costs. There were no explicit references to task

value as a factor hindering implementation. One survey respondent did report that she doesn't believe in PBL, and this was a factor that lessened her motivation. Because there were no other direct references to task value, no clear conclusions could be drawn about why the task value measure decreased between the two measurements. However, qualitative data show that student engagement and performance as well as the workload did impact teachers' motivation. It is possible that these factors serve as a source of task value. Additional research is needed to further examine possible sources of task value. Since the regression analysis indicated that task value plays an important role in implementation, it is an important motivational belief to understand.

Perceptions of school conditions-teacher participation. The teacher participation variable, which is comprised of items associated with teacher leadership and collaboration in support of PBL, also decreased significantly between Measures 1 and Time 2. There was an 11% decrease for NT teachers and a 12% for non-NT teachers. The specific items that comprise this variable are: Have instructional coaches and/or "critical friends" visits, be involved in school leadership, participate in high quality professional development, and collaborate with colleagues to plan and discuss issues. Several of these items were cited as factors that hindered implementation, which might explain the decrease in this measure.

Outcome expectancy. Of the three motivational belief variables, outcome expectancy had the lowest overall mean on both Time 1 and Time 2 for both NT and non-NT. It was also the motivational variable with the largest decrease for both NT (six percent) and non-NT (seven percent). The outcome expectancy variable was comprised

of items related to expectancy for student achievement, engagement, and motivation. These specific student-related factors were the second most frequently reported hindering factor in the open-ended survey question. This may provide some explanation for the significant decrease on this measure. The perceived student issues that teachers noted in their responses directly correspond to the outcome expectancy variable, which was designed to measure teacher expectations for student performance, engagement, and motivation in PBL classes. Given the frequency of the reports of perceived student issues as a hindering factor, this is obviously a critical aspect of PBL implementation, and therefore, a key area for educators to understand and address.

Self-efficacy. There was no significant difference in self-efficacy between the two times of measure for NT or non-NT teachers. Bandura's Theory (1997) holds that during the early stages of performance of a new task, self-efficacy tends to be instable, as the individual is constantly taking in new information and re-evaluating his or her capabilities. Given the theory, a change would be expected between the measures. One possible reason for the lack of change is that the second measure coincidentally happened to take place at a time when the self-efficacy beliefs were at a level that was similar to the first measure. Another possible reason is that two months was not enough time to receive the amount of input from the sources of self-efficacy necessary to create a significant change.

Research Question 4

Research Question 4: What do newly prepared PBL teachers report as factors that impacted implementation and motivation during the first two months of implementation efforts?

The open-ended survey questions, "What factors have facilitated or hindered your implementation of PBL so far this semester," and "What factors have contributed to or lessened your motivation to implement PBL so far this semester" revealed specific factors that teachers believe played a role in their PBL implementation efforts as well as their motivation. Almost all participants provided responses to these two questions. For the implementation factors question, there were 182 respondents (87 NT, 90 non-NT), and for the motivation question, there were 186 respondents (98 NT, 88 non-NT). Because the comments from both groups spanned the same categories and no comments were identified as being unique to either NT or non-NT schools, all comments were analyzed together.

Only a small portion (19%) of the responses was related to factors that *facilitated* implementation. The remaining 81% of the responses to this question were about factors that hindered implementation. The focus on the hindrances, rather than facilitating factors, may represent teachers' strong desire to accomplish their PBL goals. The hindrances teachers identified were primarily focused on factors external to themselves. These are the specific hurdles that they perceive are preventing or challenging progress toward the goals. The three most frequently reported categories were the same for both the implementation question and the motivation question: Time, students, and support.

The fourth and fifth most frequently cited categories of factors impacting implementation were technology and experience (including practice, knowledge, or training). The substantial overlap between the implementation factors and motivation factors is an indicator of the interrelationship between external constraints and internal processes.

Of the factors reported as impacting implementation, 65% of them were related to school structures. This is aligned with the quantitative findings of Research Question 2, which showed that perceptions of school conditions-school structures played the largest role in implementation. A more detailed analysis of the three factors most frequently reported as impacting both implementation and motivation is provided below.

Time. Adequacy of time, which was one of the school structures addressed by the survey, was the most frequently cited factor in either hindering or facilitating implementation, and the second most frequently cited factor in either contributing to or lessening motivation. The time category included constraints posed by mandatory school curriculum calendars, lack of time to plan, lack of classroom time to cover the curriculum, interruptions caused by school test dates and holidays, and juggling multiple demands while implementing PBL.

Time to cover the curriculum was a major concern. Qualitative data revealed a perceived disconnect between standardized tests (which emphasize content knowledge) and PBL (which emphasizes not only content, but also skills that are not tested on State exam, such as critical thinking and communication, for example). A number of teachers did not feel that they had enough classroom time to ensure positive outcomes for both of these seemingly distinct types of learning. One NT survey response stated, “I don't have

enough time in my 44-minute class periods to get through the material I need to cover. Throwing in a PBL unit only puts me farther behind with my traditional instruction." Similarly, another NT survey respondent explained, "Being high-stakes state-tested requires me to move at a certain pace throughout the year to ensure I cover all materials. At times, I need to teach without PBL to ensure all students understand fundamental and/or vital content standards."

Teachers noted that some students come to the classroom lacking in foundational skills, such as reading and writing, while others lack the social skills needed for working in groups. Given accountability pressures, some felt that were not able to sacrifice direct content instruction time to teach PBL skills, due to potential risks of low standardized test scores and development of foundational skills: (Survey, non-NT)

> The students' academic abilities have hindered implementing PBL. Since my students are so young, and struggling with grade level academics, it is hard for me to spend extra time discussing a project when I would rather be doing interventions to help them read and do basic skills.

These comments bring to light these teachers' perspective that their role is to cover the curriculum to prepare students for standardized tests, and that doing so relies heavily on direct instruction. Further, the comments draw a contrast between the curriculum and the 21st Century skills that students learn through PBL, such as communication, collaboration, critical thinking, research, and self-regulated learning. This contrast hinders implementation, according these teachers' comments:

> I think the focus on standardized assessments has really hurt the focus on PBL. While students can achieve mastery of standards through PBL, ultimately there are a lot of skills that PBL focuses on that simply aren't tested on those forms of assessment. (NT, survey)

> I work in conjunction with a fully integrated PBL class. My opportunity to use PBL is very limited since it is my job to cover the standards that PBL does not. (Non-NT, survey)

Mandated curriculum calendars were also problematic for PBL implementation (Non-NT, Survey): "I work in a school with a curriculum calendar and uses the 8-step process. There is very little time in the day that allows for PBL. I feel accountable to the calendar."

The tension between teaching 21st Century skills and content standards is obviously a significant hindrance to PBL implementation for these teachers. What is unclear is how much of this problem stems from teachers' lack of knowledge and experience with integrating content with 21st Century skills, how much is a result of accountability pressures, and how much is due to a lack of classroom time.

The amount of time required for planning was also a substantial concern for teachers. One NT survey respondent stated that developing a detailed, well-organized plan for a three-to-four-week project could take 30-40 hours. A NT teacher stated (Survey):

> The amount of work that goes into planning a PBL can also hinder even the most well intentioned teachers, it requires A LOT of additional planning to thoroughly plan a project and make sure all the necessary components are present.

BIE validates teachers concerns about the work that goes into planning projects: "Good projects do not occur by accident. They result from rigorous up-front planning that includes thoughtful outcomes, timelines, and management strategies" (2003, p. 13). This is in contrast with planning practices of teachers in general (not those working with PBL), who spend an average of 10 to 20 percent of their working time each week on planning activities (Arends, 2009). Based on a 40-hour work week, this equates to four to eight hours a week, or 16 to 32 hours over a four-week period. By contrast, the bulk of PBL planning takes place up front. For a four-week project, a teacher may put in the same number of hours or more before the project begins, while the planning activity throughout the project is minimal.

Students. Perceived student struggles were the second most frequently reported factor as either hindering or facilitating implementation and the most frequently reported factor as either contributing to or lessening motivation. Specific perceived student issues identified as hindering implementation included students' perceived low academic abilities, inadequate progress toward mastery of content standards, behavior problems, inability to be self-directed or employ self-regulation, inequality in contributions to group

work, and expressing opposition to PBL. This sentiment expressed in a non-NT teacher survey response stated is representative:

> The students I have this year have not been very successful in school and don't have many of the skills to work on their own or with others and have very little confidence in their own abilities. Just trying to get them to do simple tasks is a struggle some days. Sometimes it is lack of skills, sometimes lack of motivation—it just depends on the student.

Such concerns about students' difficulty transitioning into more active roles is well-documented in prior research (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, and Palincsar (1991; Brush and Saye, 2001; Ertmer & Simons, 2006). There are numerous factors that could be at play here. One such factor could be that students, who have become accustomed to more passive forms of learning, may need support in developing SRL abilities such as motivation, goal setting, self-monitoring, and self-evaluation. Some survey comments convey a sense of hopelessness regarding students' ability to develop such skills: "My implementation has been hindered by students who are unmotivated to learn and who completely shut down when given a problem or task they don't understand" (NT) and "Students do not work well in groups. There are many discipline issues and students talking about unrelated topics. I've seen a lot of 'good students' pulled down by others in their groups who don't do their work." (Non-NT)

However, other comments signal recognition of students' ability to learn such skills: "My current group of students has been in at least one PBL classroom for the last two years. I'm able to do much more with them this year, because they're already PBL

veterans" (NT), "It is a struggle, as always, to bring learners up to speed on the culture and the process, but this is a welcome challenge" (NT), and "The students have pushed back against PBL, but I have held my ground and they have come through with final products and seen the need to be responsible for their learning." (NT)

An understanding of specific strategies that teachers can employ to develop students' SRL in PBL is critical. At the same time, this was a relatively weak area for teachers in this study, according to the mean measures of outcome expectancy items. Of all the individual items from the three motivational belief scales, the only items that had a mean below 80 (for all participants) were the outcome expectancy items, "I can teach students self-regulation skills (such as goal-setting, self-monitoring, reflection) and "I can effectively manage classroom time during PBL. The research on how teachers can support students' development of SRL in PBL is quite limited. Research on self-directed learning and student responsibility for learning in other student-centered approaches may be informative, however. Knowledge gained from such studies suggests that students' transition to student-centered methods should be done gradually, with appropriate modeling, scaffolds, formative assessment, and feedback (Barron, et al., 1998; Peters, 2010; Polman, 2004). While this work requires new knowledge and skills from the teacher, when students succeed, teachers experience a high level of satisfaction and motivation, as expressed in this survey response: "I am working harder than I ever have, but it is completely rewarding. I see my students creating quality work and being excited about it."

Support. Support was the third most frequently reported factor either hindering or facilitating implementation and the third most frequently reported factor either contributing to or hindering motivation. In interviews, teachers were asked what it means to have a supportive school environment. Responses pointed to financial support, coaching and encouragement, receiving help before asking for it, getting questions answered without fear of penalty, having people to "bounce ideas off of." In survey responses, specific sources of support mentioned were district support, administrator support, parental support, and colleague support. The fact that a variety of stakeholder groups were identified as sources of support speaks to the systemic nature (Reigeluth, 1994) of the changes required for PBL. Some of the interviewees discussed the advantages of school wide support for PBL, including clear and consistent expectations for students, understanding from parents, shared vision and values, synergy that results from collaboration with other teachers, inspiration that results from observation of other teachers, and ample tools and resources. Some teachers recognize the importance of such support: "It helped our school a lot that we are starting a new school that is wall-to-wall PBL. I think this would have been harder if just a few people in the building were trying to implement this on their own" (non-NT). Survey comments elucidated the specific role that each of stakeholders plays in supporting PBL.

District support was identified as providing appropriate policies, as expressed by a non-NT survey respondent: "PBL has been hindered by outside forces such as district mandates of common assessments and lack of full district support." Others focused on the

importance of funding from the district for professional development, technology, and resources.

The types of administrator support that emerged from survey responses included understanding, knowledge, and guidance. One NT teacher stated: "Factors that have contributed are co-workers' support and a great director (NT term for the school leader) who has a lot of knowledge regarding PBL and how to implement it!"

The role of colleagues in supporting PBL efforts, as described by participants, is to provide much needed motivation, knowledge, and collaboration: "Factors that have contributed to my motivation to implement PBL are support from colleagues and administrators and highly motivated colleagues and administrators who also want to implement PBL effectively" (non-NT). Similarly, a NT teacher said, "Helping our implementation has been a strong group of teachers who have bought into the value of teaching in the PBL model." Several interviewees expressed gratitude for opportunities to brainstorm with other teachers, to observe their peers, and to collaborate, as exemplified by this statement from a NT participant: "I have had fun thinking up projects and working with my co-teacher."

Support needed from parents, as reported by survey participants included buying into the PBL model and assisting students at home, as expressed here (non-NT):

> I have relied on my parents to assist their child in getting the pieces to put our project together. I highlighted the driving questions and the final project plan, sending it home to parents with specific instructions on what

the expectations were. What came back was very discouraging. I am ready to try again and keep the project closer to me.

These survey comments illustrate the implication of support—and lack thereof—for teachers who are undergoing a paradigm change in their classroom practices. Support in this case included both tangible support in the form of money for training and tools or assistance from parents at home, for example, well as less concrete aspects of support, including energy, motivation, knowledge, and confidence. The support that these teachers identified as important came from a variety of sources, reflecting the systemic nature of the transition to PBL.

Technology. Technology was one of the "school structures" scale items. Previous research has found student access to technology to be instrumental in PBL success (Ravitz, 2010). However, according to Schrum and Levin (2012), "Technology is wonderful until it isn't" (p. 51). This proved to be true for the teachers in the current study, including teachers NT and non-NT schools who frequently cited technology as hindering PBL implementation and dampening motivation. As one NT teacher put it, "Student energy is up, but the tech issues outweigh the vibe." A variety of frustrations were described, such as lack of access to computers or the Internet, challenges of students becoming distracted by the technology, difficulties with outdated technology, and also a struggle for the teachers to learn to use the technology. A survey response from a NT teacher illustrates how technology can be a double-edged sword:

Technology hindered and facilitated implementation. We had great access to information and ways to collaborate through Google Docs, but

it was also very distracting for the students. I was constantly battling their desire to play games or look up things not related to class.

Student access to technology in the participating schools varied from occasional access to a computer lab to one-to-one laptops for all students. While PBL can be done without computers and network connections, the benefits of authenticity, 21st Century skills, and community connections seem to be severely diminished without such tools and access. PBL is centered around inquiry and product creation, and therefore, being able to conduct online searches and create products using computers are important aspects of the learning process. For teachers, hardware and software that are not functioning properly can serve to create frustrations. For students, lack of policy and training guide proper classroom use of computers and other electronic devices can detract from the learning process.

Experience, practice, knowledge, or training. The regression analysis showed that PBL experience (including PBL teaching, learning, pre-service education, and professional development) played a significant role in PBL implementation. Additionally, a comparison of means of the high experience group and the low experience group showed that those with higher levels of PBL experience also had higher measures of motivational beliefs. The importance of PBL experience was reiterated by responses to the open-ended question about factors that impacted implementation. A lack of practice, knowledge, or training was frequently cited as hindering implementation. In one example, a NT teacher explained, "I do not understand what PBL should ideally look like. The NTN conference I attended gave me an intro to PBL but I am still very confused

about what it should look like in my classroom." Another NT teacher stated, "I am new to the process, so it is a huge learning curve for me. That has been my biggest hurdle."

According to self-report data collected on Survey 1, many of the participating teachers had not had any substantial exposure to inquiry-based methods prior to the introductory training during the summer. Most of them did not have in-depth instruction about it during their pre-service education (90%). PBL requires students to construct their own knowledge (Mergendoller, 2006). This invisible change in internal learning processes necessitates change in external practices including student and teacher roles and methods of planning, assessment, and feedback. Instilling what for many are radical changes takes knowledge, time, practice, and feedback. Like students, learning for teachers is a socially mediated process (McDiarmid & Clevenger-Bright, 2008). Several survey responses expressed appreciation for the opportunity to learn from peers:

"The fact that we do this school wide as facilitated my learning." (NT)

"It is an extremely difficult method to adopt. I make quite a few mistakes, but other than that, all of my coworkers have been amazing in helping me." (NT)

> We are all trying to figure it out. I do know that other teachers in my building were able to complete their projects, though...so maybe it is just me. I know that when I heard they were working on something it would get me excited again. Maybe we should have checked up on each other a little more (Non-NT).

PBL is new territory for many teachers, regardless of what stage of their career they are in. For seasoned veterans, there is a process of unlearning and relearning, as explained by one survey respondent (NT):

> I have 21 years of traditional teaching experience. I have been inundated with new teaching strategies and training opportunities, which I have taken advantage of, but it will take me additional time to incorporate all this into my daily routine. I am unlearning, relearning, and refining old practices to integrate them into PBL practices.

The implication of this is that integration of PBL may work most effectively when ample time is given to allow for learning during implementation.

Summary

In summary, when asked about factors that impacted their implementation of PBL and their motivation, teachers focused heavily on factors that negatively impacted them. Many comments seemed to convey a sense of frustration, which is a sign that progress toward goals is impeded or blocked. The frustration that is experienced can sometimes be a precursor to disengaging from goals (Carver & Scheier, 2005). The factors most frequently impacted implementation were the same as those that most frequently impacted motivation, indicating a close relationship between the two. The factors most frequently identified as impacting implementation and motivation were the same: Time, students, and support. Technology and experience were also important. Based on the reports here, PBL-conducive environments seem to have both the necessary physical infrastructure and training, and the less tangible supports of encouragement and

reinforcement of efforts. The matrix below provides a snapshot of the factors most frequently reported as impacting implementation, with corresponding representative quotes and the key perceptions communicated.

Table 33

Matrix of Key Perceptions Communicated

Factors impacting implementation and/or motivation	Representative Quotes	Key Perceptions Communicated
Time to cover the curriculum	I work in conjunction with a fully integrated PBL class. My opportunity to use PBL is very limited since it is my job to cover the standards that PBL does not.	A focus on 21st Century skills conflicts with accountability pressures to teach content standards. A focus on 21st Century skills conflicts with the need to support students who are lacking in fundamental skills.
Time to plan	The amount of work that goes into planning a PBL can also hinder even the most well intentioned teachers, it requires A LOT of additional planning to thoroughly plan a project and make sure all the necessary components are present.	Current course and workflow schedules do not allow time for up front planning. There is not adequate time in the workday for planning and implementing while learning.
Students – Lack of fundamental knowledge and skills	The students I have this year have not been very successful in school and don't have many of the skills to work on their own or with others and have very little confidence in their own abilities. Just trying to get them to do simple tasks is a struggle some days. Sometimes it is lack of skills, sometimes lack of motivation—it just depends on the student.	A lack of student proficiency in fundamental knowledge and skill serves as a hindrance.

Students – Lack of motivation, negative attitudes toward PBL	My implementation has been hindered by students who are unmotivated to learn and who completely shut down when given a problem or task they don't understand.	Lack of student motivation is a hindrance to implementation and teacher motivation. Students' pushback against PBL is a hindrance.
Support	It helped our school a lot that we are starting a new school that is wall-to-wall PBL. I think this would have been harder if just a few people in the building were trying to implement this on their own.	Support from colleagues is helpful for brainstorming, collaborating, motivating. Support from parents is needed to provide assistance to students at home. Support from school leaders is needed to provide a risk-tolerant environment, coaching, and guidance.
Technology	We had great access to information and ways to collaborate through Google Docs, but it was also very distracting for the students. I was constantly battling their desire to play games or look up things not related to class.	Outdated or poorly functioning hardware and software hinders implementation and motivation. Teachers' lack of experience with integrating technology in student-centered ways can be a hindering factor. Technology sometimes serves as a distraction for students, taking them off-task.
Experience, practice, knowledge, or training	I do not understand what PBL should ideally look like. The NTN conference I attended gave me an intro to PBL but I am still very confused about what it should look like in my classroom.	A lack of practice, knowledge, or training can be a hindrance to implementation. PBL has a steep learning curve.

The challenges reported here are similar to those identified in prior PBL research as well. Marx, et al. (1997) found common teacher challenges to be not enough time, a disorderly classroom, inability to control the flow of information, difficulty balancing student independence and support, issues with incorporating technology, and difficulty designing assessments. Bradley-Levine, et al. (2010) found that ample technology, availability of coaches and "critical friends," supportive administration, supportive teacher leaders, and time to plan and collaborate were critical implementation factors for PBL teachers. Similarly, Ravitz (2010), found certain school conditions to be positively correlated with PBL use, including block or flexible scheduling, team teaching, school-wide rubrics for assessing student work, online teaching and learning strategies, teacher involvement in school leadership or decision-making, and instructional coaching or critical friends visits.

The established knowledge base shows that multiple layers of integrated change and support are necessary to sustain PBL implementation. A longer process of implementation also seems advantageous, to allow more time for the learning to take place with less stress. Given the established knowledge base about the challenges of PBL and the environmental features that can ease those challenges, educators have an opportunity to re-examine how they structure the policies, daily operations, work flow, team configurations, and the timeline upon which they schedule the integration of PBL. Quantitative data showed that NT teachers, who were in an environment specifically designed to support PBL, had higher measures than non-NT teachers on several of the variables of interest. However, in reviewing the survey comments, there are no

discernible differences between the two groups. One implication of this is that NT schools, many of which have been successful in their PBL implementation, may still have room for improvement, particularly in the process of integrating new teachers into the schools. Some of the lack of knowledge and frustration expressed may signal a need to slow the process and make the transition more gradual. A second implication is that prior experiences have a significant impact in shaping teachers' perceptions and expectations. It seems that perceptions are an integral part of teachers' motivation to move toward the PBL implementation goals, and therefore are an important consideration for school leaders who are communicating with and providing training and support for teachers who are new to PBL.

Conclusion

In this study, perceived value was an important element of teachers' willingness to commit to PBL. Teachers in this study who committed to the steep learning curve and necessary changes valued PBL; the value they perceived for their students, for themselves, their career, and their school's goals made the work worth it.

The measure of perceived value in this study decreased during the first two months of initial implementation, which illustrates a discrepancy between expectations and the reality of what they experienced during initial efforts. Despite this initial decrease, other data showed that those with higher levels of PBL experience had higher levels of perceived PBL value, indicating that over time, teachers who continue to teach with PBL continue to see it more positively. This may be explained by improved effectiveness and rewards of student success that result from ongoing training, practice,

and feedback. Perceived value for study participants seemed to be shaped by a variety of sources, including enjoyment of the creative process and positive pre-service education experiences. The most powerful influence, however, seemed to be observation of students experiencing high levels of motivation, engagement, or performance. Learning how rewarding and motivating PBL can be for students can provide the spark that motivates initially reluctant teachers to give it a try. Another important influence on perceived PBL value seemed to be the school environment. Teachers in PBL-conducive environments had higher levels of perceived value for PBL.

Though important, positive perceptions of PBL proved to be less important than perceptions of school conditions in explaining the extent of implementation. Those in environments perceived to be more PBL-conducive implemented PBL to a greater extent. This suggests that if the environment does not provide the necessary affordances or structures to support PBL, sustained implementation should not be expected. Even the most motivated teachers in this study were challenged to meet the demands of PBL planning, classroom management, and logistics coordination while ensuring student success and juggling other professional and personal priorities. Lack of time (or an inappropriate allocation of time), a curriculum that does not integrate PBL, and inadequate student access to technology are serious barriers to sustained implementation. On the other hand, schools that provided ample professional development, opportunity for collaboration, common planning time, a flexible curriculum, and ample technology and other resources enabled successful implementation.

Many teachers in this study were challenged or deterred by perceived lack of ability or lack of willingness of students to take responsibility for their learning. Findings suggested that teachers did not believe that they were able to influence student motivation and learning in PBL. Relatively high measures of self-efficacy and relatively low measures of outcome expectancy indicated that even when teachers believed they were capable of performing the teaching tasks associated with PBL, they had relatively low expectations for student success. This disconnect indicates a teacher belief that lack of motivation or low level academic skills are innate traits of the individuals, rather than manifestations of the learning environment. This is a critical issue to address, as it is less likely that teachers would be willing to sustain an extended process of learning and effort to implement an innovative pedagogy when they believe the success or failure is not dependent upon their level of knowledge, skills, and effort.

Implications for Practice

This study examined teachers—most of whom were new to PBL—in the early stages of their attempts to implement PBL. Specifically, the study sought to identify the role that these teachers' motivational beliefs and perceptions of school conditions played in the extent of their implementation during the first two months of the school semester following introductory PBL training. In this section, practical implications are discussed in light of the findings.

Recommendation 1: Utilize a school wide emphasis on PBL implementation. This study provided some evidence of advantages that can be gained from a school wide emphasis on PBL. Focusing resources and energies on a common approach and goal can

facilitate teacher collaboration and support students' transition to a student-centered approach, which teachers reported as important to PBL implementation. Previous studies have also shown that successful implementation of educational innovations involves a number of pedagogical, technological, and managerial factors (Cuban, 1988; Cunningham, 2009; Darling-Hammond, 2000). Further, Schrum and Levin (2012) concluded that all of the interacting, interrelated, and interdependent components in an educational organization must be addressed in concert to create sustainable change.

Ample planning time, block or flexible classroom scheduling, a PBL-supportive curriculum, student access to technology, and common expectations for students are key components of a school wide emphasis on PBL. Designing the organization to foster these features may require non-traditional roles and organization of teachers and teaching resources. Miles and Darling-Hammond detailed alternative ways of deploying instructional resources in focused ways to support a school's instructional goals and strategies (1998). Through case examples, the authors examine how five high-performing public schools organized their resources in innovative ways to "support student achievement at extraordinarily high levels by managing instructional resources to maximize individual attention for students and learning time for teachers" (p. 10). Six principles of resource reallocation were identified: Reduction of specialized programs to provide more individual time for students in heterogeneous groups; flexible student grouping; structures that create more personalized environments; longer and varied blocks of instructional time; more common planning time for staff; creative definition of staff roles and work schedules (Miles & Darling-Hammond, 1998). Given the

specialization of teaching tasks within the PBL environment, including planning, scaffolding, and fostering student responsibility for learning, these suggestions appear to be quite relevant to PBL. As the authors noted, these were just a few examples of how the school organization can be structured in non-traditional ways to find efficiencies and support goals.

Recommendation 2: Transition slowly into PBL. Many of the teachers who participated in this study were challenged with the demands of ensuring that their students were learning while they themselves were learning a new way of teaching. This was true even for some who were in schools designed to support their efforts. In some cases, teachers were expected to fully adopt PBL after having only one professional development experience. A much slower pace of transitioning into PBL is recommended to allow time for planning, learning, reflection, and adjustment, as well as time for students to transition to this new way of learning. The specific targets for implementation may vary according to the each individual's PBL-specific education and training, years of teaching experience, strengths and preferences, and experience with technology and student-centered approaches. For some who are brand new to PBL, one project in a school year may be the maximum that can reasonably be expected. For others, two or three projects in a school year may be appropriate until a greater level of comfort and proficiency are gained.

Recommendation 3: Align the curriculum with PBL. A shortage of classroom time was one of the factors most frequently reported as hindering PBL implementation. According to interviews and responses to open-ended survey questions, one source of

classroom time shortage is a perceived conflict between what teachers are held accountable for (covering the curriculum and improving student scores on standardized tests) and what they need to teach students in PBL (interpersonal communication, critical thinking, collaboration, etc.). A number of teachers report that there is not enough class time to effectively fulfill both responsibilities and that with accountability pressures, they are not comfortable forgoing direct instruction—particularly for students who are behind in fundamental skills. Curriculum pacing guides, in particular, seem to hinder PBL, since PBL's student-centered approach does not lend itself to covering certain segments content on certain days.

Integration of PBL may be accomplished more smoothly with a curriculum that aligns to the pedagogy. The partnership for 21st Century Skills has developed a framework that illustrates how 21st Century skills and knowledge can be aligned with standards and assessments, curriculum and instruction, professional development, and learning environments (Partnership for 21st Century Skills, 2011). This framework is a valuable reference for planning a cohesive model of teaching and learning that emphasizes 21st Century skills. Further, teachers need knowledge and experience in how to integrate content with PBL skills. Collaboration and an interdisciplinary approach may be beneficial.

Recommendation 4: Support students' transition to PBL. The shift to a student-centered classroom is new not only to teachers, but also to students. In this study and in previous studies, low levels of student motivation and performance, as well as student "push back" against PBL were found to interfere with implementation as well as

teacher motivation. While students in PBL need to take responsibility for their learning and learn new ways to learn, this process may not come naturally or easily (Brush & Saye, 2001). Therefore, students new to PBL need support in making this transition. First, the expectation for students to take responsibility should be explicitly explained to students. One of the NT teachers interviewed explained that one of the first projects they have students new to PBL do is to create a video public service announcement to explain what PBL is. This gives them an opportunity to learn about PBL while doing PBL.

Next, social cognitive theory holds that teachers can help students become self-regulated (Zimmerman & Kitsantas, 2005). Self-regulated learners are able to effectively set goals, plan a course of action, select appropriate strategies, self-monitor, and self-evaluate their learning. Self-regulated learners are also highly self-motivated. Research shows that teachers can teach students to develop these skills through thoughtfully designed learning activities and communication (Barron, et al., 1998; Kitsantas, 2002; Peters, 2010; Polman, 2004; Zimmerman, 2008). One strategy that has been found to help the transition to a student-centered classroom is for teachers to scaffold the development of teamwork and critical thinking skills before beginning a project (Peters, 2010). Additionally, teachers have found that utilizing activity templates and specific patterns of dialogue can lead to the routinization of unfamiliar learning activities in PBL (Polman, 2004). Further, as explained by interviewees, having the same norms and expectations across grades and across classrooms supports students in more quickly form new intellectual habits and learning practices.

When planning projects, ample time should be built into the schedule, especially in the beginning of the project, for helping students learn to learn. The amount of time and the types of support needed to successfully transition to student-centered learning may vary by students' particular needs, including age as well as level of knowledge and skill in fundamental areas. When working with students who are behind in basic skills, BIE recommends including more direct instruction during a project, designing shorter projects, and tying projects to fewer, more specific standards (2003).

It is important for teachers to understand the developmental and situational nature of SRL and to provide instruction and supports that foster these skills. By doing so, teachers may experience not only greater student motivation and more positive outcomes, but also, potentially, greater enjoyment or intrinsic rewards. To learn strategies for fostering student self-regulated learning, teachers may benefit from ongoing professional development, feedback, coaching, observations, and peer networking. Additionally, in order to better provide support at home, parents and other caregivers would benefit from education about how PBL works and why this method is being used.

Recommendation 5: Create efficiencies in the project planning process. Participants in the current study and those in at least one previous study (Bradley-Levine, et al., 2010) have found planning for PBL to require more in-depth planning up front than teacher-directed methods. This may be the case for other student-centered methods as well. According to Peters (2010), "The teacher's role in student-centered classrooms lies more in the setup of the learning environment than in the direct delivery of information" (p. 337). This statement brings to light the fact that because teaching has traditionally

emphasized direct instruction, many teachers do not have knowledge of or experience in designing learning environments. According to BIE, creating good projects requires vision and a solid understanding of the learning process (2003). BIE recommends a using a Backward Planning (or similar) method for PBL (2003). Backward Planning begins with identifying specific knowledge and skills that students are to develop, and working backward from there to plan instructional activities (Wiggins & McTighe, 2005). The ability to create effective PBL projects and learning environments is essential. Teachers without experience with this and other methods of instructional design would benefit from training on the topic.

In comparing planning methods for traditional instruction with PBL planning, it may be that the real difference occurs not in the amount of time spent on planning, but the allocation of the time. Whereas planning is typically done at a steady pace throughout a lesson when using traditional methods, the bulk of the planning in PBL takes place up front. Therefore, allocation of time is an important consideration when determining school schedules, project launch dates, and possible team teaching configurations.

One strategy for creating efficiencies in the planning process, as suggested by participants, is for teachers to work collaboratively on interdisciplinary projects. This is especially helpful when collaborative planning time is allocated during the day. Another way that planning time can be reduced is for teachers to share project plans and rubrics. Some schools have collaborative planning systems that facilitate this process. Additionally, extensive collections of existing projects can be found online. Further,

several teachers mentioned that having an opportunity to network with other teachers who teach the same grade and subject is helpful in generating project ideas.

Recommendation 6: Provide ongoing professional development and access to peers and experts. Given the complexity of PBL, ongoing professional development and access to peers and experts are critical to teachers' success. As teaching is now recognized as a socially mediated practice, the development of expertise has become accepted as a collective outcome, rather than an individual phenomenon (Grant, 2008). Generally, teachers said that the most helpful experiences are practice with feedback and coaching. This fits with Tschannen-Moran & McMaster's findings that mastery experiences are effective in improving self-efficacy and implementation of an educational innovation (2009). Other experiences teachers in the current study said they would find valuable are seeing project examples, sharing experiences with peers, observing PBL in schools like theirs, and seeing a model of PBL from beginning to end. Given these suggestions, lesson study (Lewis, Perry, & Murata, 2006) and video clubs (Sherin & Han, 2003) are two examples of informal, teacher-led, collaborative professional development models that could be effective for PBL professional development. Lesson study involves a group of teachers selecting an instructional strategy, technique, or approach to study, conducting inquiry about the selected teaching activity, practicing it in the classroom, then coming back together to reflect and discuss ways to improve processes and outcomes (Lewis, 2002). Similarly, in video clubs, groups of teachers watch video of themselves and their students in the classroom and identify effective practices those that need improvement. Critical areas of focus for PBL training are transitioning from the role

of content expert to the role of facilitator, creating assessments, using Backward Planning or planning similar methods, and supporting student self-regulated learning. The literature on what makes professional development effective is extensive, and the resulting list of critical features is exhaustive. One study of more than a thousand math and science teachers, however, seems to be particularly relevant. Researchers found essential characteristics of professional development to be higher number of contact hours, collective participation, active learning (including observing and being observed), focus on content knowledge, and alignment with school goals, policies, and standards (Garet, Porter, Desimone, Birman, & Yoon, 2001).

Recommendation 7: Develop a comprehensive technology plan. While projects can be conducted without technology (Buck Institute for Education, 2003), technology was one of the most important elements of the PBL environment for the participants of this study. Adequate student access to Internet access, up-to-date computers and software, and portable devices (such as iPads), were reported to facilitate PBL implementation. However, when such access was inadequate, technology was reported as hindering implementation. Outdated computers and lack of access resulted in distractions, frustrations, and an inability to complete planned activities. For educators undertaking a PBL initiative, technology is an important consideration that requires extensive planning. Funding sources, technology infrastructure and support, ongoing professional development, and policies are a few of the aspects that must be planned to integrate and sustain technology (Levin & Schrum, 2012).

Recommendation 8: Provide in-depth learning experiences in PBL and other student-centered methods in pre-service teacher education programs. More than 90 percent of the teachers who participated in this study indicated that in their pre-service teacher education program, they had little to no instruction about PBL or other forms of inquiry-based learning, such as problem-based learning, inquiry-based instruction, or discovery learning. Clearly, in-depth learning experiences in PBL and other student-centered methods during pre-service education are greatly needed. The UTeach Program is an example of a teacher preparation program that provides significant study of student-centered methods. As part of a required sequence, for example, undergraduate math and science students take an entire course focused solely on project-based instruction, in which they teach project-based lessons to middle school students (University of Texas at Austin, 2013). In other required courses, they observe inquiry-based instruction in classrooms and create and teach lessons. The program was founded at The University of Texas at Austin in 1997 to prepare secondary teachers in STEM fields (science, technology, engineering, and math) (UTeach Institute, 2013). Due to its success and high levels of interest, the UTeach Institute was established in 2007 to replicate the program at other universities and to support continuous improvement of the model. The UTeach program is now in place at 34 universities in the U.S. There are other teacher education programs that offer extensive instruction in student-centered methods as well; this is just one example.

Limitations

There are multiple limitations to be considered in determining validity and generalizability of this study. This section describes limitations related to the study population, measures, and data collection processes.

The study population was not a random sample, but rather is made up of intact groups who attended professional development activities together in three locations. Data collection sites were selected based on access to the participants who fit the criteria. Finally, the number of participants who completed the second survey (N = 187) was relatively small. These factors limit the generalizability of the findings.

While self-report data are well-suited for measures of motivational beliefs, the validity of the implementation measure and the school conditions measurement may have benefitted from an objective measurement. Observer data, for the purpose of validating implementation data, were collected from a limited number of coaches and lead teachers (15). While the data were highly correlated between teachers and their matched observer, validity is not ensured. Qualitative data and collected artifacts provided descriptions of a limited number of PBL projects. While this provides some evidence that the PBL model was being utilized, the evidence was limited. There was no objective measure of school conditions. Also, the Extent of Implementation Measure was designed to measure the number of projects teachers implemented. While the number of projects is one indicator of how fully a teacher embraced PBL, the measure does not take into account variations in length and complexity of a project. In others words, a teacher who implemented one long, complex project may have embraced PBL to the same extent as a teacher who

implemented two or three shorter, more simplistic projects, but this would not be revealed by the Extent of Implementation measure. To enhance validity and reliability of measures, the researcher utilized scales that were modified versions of scales used in previous studies. The scales underwent validity checks and were utilized in a pilot of the current study, and subsequently fine-tuned.

This study did not measure all of the features of NT schools. Therefore, there could be unexamined factors at play in the differences between NT and non-NT schools. Those differences include a small school size of 400 – 500 students, school planning, principal training, and personalized coaching from the NT Network, for example (New Tech Network, 2012). Further, 16 non-NT teachers reported that their schools had a school wide emphasis, indicating that their schools may have had affordances similar to those in the NT schools.

Some response bias may have resulted, on several different levels, from those who had the opportunity to complete the survey, as well as those who chose to complete the survey. At the first level, NT teachers who participated in the study had already made a commitment to fully adopt PBL, due to school requirements. This means that their commitment to fully adopt, as indicated on Survey 1, would be expected to be higher, regardless of their motivational beliefs. At the next level, the non-NT teachers were self-selected and therefore may have been more interested in PBL than the general population of teachers. On the next level, those participants who felt more strongly about issues related to the study than the general participant population may have been more inclined to respond to both surveys, to provide more in-depth responses to the open-ended

questions, and to participate in an interview. Those who did not participate may have held different perspectives. The incentives for participants to complete the survey may have reduced the occurrence of this issue. The comparison of demographic data and measures of key variables for those who completed Survey 2 showed a high degree of similarity between the two groups. Further, almost all participants who completed Survey 2 provided a response to each of the open-ended questions, though some more detailed and descriptive than others.

The open-ended questions about factors that impacted implementation and motivation elicited a high percentage of responses about the factors that negatively impacted them. For the small percentage that were positive, it would have been helpful to know more detail about what was working for them. If a response indicated that the school leader was highly supportive, for example, it would have been helpful to know what, specific support that individual provided. For participants who experienced success with students, it would have been helpful to learn more about what teachers perceived as the reason for the success—such as particular teaching practices, certain features of the classroom or school culture, or particular demographic characteristics of the students, for example. Additional information about the schools where the teachers were teaching would also be helpful, such as whether the school was a charter school or magnet, whether the school had been labeled as a "failing school," who their leaders were, and how long teachers at the school had implementing PBL. This information would shed light on additional contextual factors that relate to successful and less than implementation efforts.

The interviews were conducted by telephone and were fairly limited in duration. Without sufficient opportunity to establish trust before the interview and without the benefit of seeing facial expressions and body language during interviews, richness of data may have been impacted. These two factors may have inhibited responses and hindered the researcher's ability to identify appropriate points for elaboration on responses.

The limited length of the study may limit the conclusions that can be drawn. Because implementation of complex innovations may go through various cycles of experimenting, resorting to former methods, and experimenting again, additional data, collected at a later time, would be valuable in identifying trends and patterns in PBL implementation and what factors played a role in persistence.

Further, the qualitative data were subject to researcher bias. To reduce the potential for this, the qualitative survey responses were coded by a second rater. Further, the telephone interviews were designed to be very open-ended to avoid injecting assumptions that could potentially impact the direction of the interview. The interviews typically started with a question about the school, such as "what has been happening in your school with regard to PBL?" This was followed either by a follow-up question about the response, or followed by a question about the individual's personal experience, such as "how has your PBL implementation experience been so far this semester?" From there, the interview was unstructured and questions probed further into responses given. Interviews were transcribed fully and notes and highlights were added after other analyses were completed.

Recommendations for Future Research

This study produced some useful findings. It is recommended that the study be replicated with some changes to enhance generalizability and validity, and to build on knowledge gained. To improve the generalizability of the findings, this study could be replicated with a larger population. To enhance the validity, future research may replicate this study with the use of objective measures for extent of implementation as well school conditions. Further, the code list for the survey data could be reused and refined. The data collected in this study covered a fairly short period of time. Continuing this study over a longer period of time would provide a richer set of data and deeper understanding of patterns of motivation and implementation.

This study produced some findings that correspond to previous research, and some findings that provoked questions that signal opportunities for future research. For example, for those teachers who reported factors that facilitated their implementation, future research might seek to identify details of the facilitating factors, such as characteristics and practices of supportive leaders and colleagues, and teaching practices and characteristics associated with student success in PBL. Additional information about the schools where PBL was successful or less than successful would be helpful, such as whether the school was a charter school or magnet, whether the school had been labeled as a "failing school," who their leaders were, and how long teachers at the school had implementing PBL. This information would shed light on additional contextual factors that relate to successful and less than implementation efforts.

Task value was an important motivational belief in this study. It would be valuable to further examine sources of task value. There did not seem to be any correlation in the current study between task value and years of teaching experience or learning preference. Task value was significantly correlated with perceptions of school conditions, self-efficacy, and outcome expectancy. Since task value was an important motivational belief for the teachers in this study, it would be useful to learn more about its sources.

Because perceived student issues were clearly very important to PBL implementation and to motivation, according to qualitative data, it was surprising that outcome expectancy did not play a significant role in implementation. Bandura's theory (1997) suggests that outcome expectancy does not predict behavior when the outcomes are perceived to be beyond the individual's control. Follow-up research might integrate a measure to assess how teachers attributions of student engagement performance, and outcomes, and sources of self-attribution for these outcomes, and whether those attributions change when teaching with teacher-centered methods.

Also related to students, it would be valuable to study how teaching practices and learning environment design impact student self-regulated learning. Specifically, an intervention study would be of particular interest. Further, a study of how students' self-regulated learning relates to task value would be informative.

Several comments from participants indicated that as their ability to plan and execute projects improved, so did student performance. Additionally, some indicated that as students became more proficient learners in PBL, they were able to teach more

effectively. It would be valuable to conduct a case study to examine the development of students and teachers new to PBL. Such a case study might be framed to answer a question such as "how do the PBL perceptions of a teacher and his or her students evolve over the course of their first semester of teaching and learning with PBL?" This would provide additional knowledge about the interaction between students and teachers and how the performance of each might be improved. Further, a similar case study could be conducted with an expert teacher and students new to PBL to identify practices that the teacher uses effectively to engage students productively in PBL projects.

Final Thoughts

The results of this study indicate that motivation is a necessary ingredient for PBL teachers, but even the most motivated need a supportive environment to sustain their efforts over time. A PBL teacher in a school without the necessary school structures may be compared to someone swimming upstream against a strong current. While teachers need motivation to take the leap into the water and put forth the effort to practice and learn, the school current can either feed the momentum toward the goal, or slow progress and thwart motivation. The demands of today's workplace that have resulted from the rapid evolution of technology, flood of digital information, and worldwide connectedness require students to leave school equipped with 21st Century skills such as critical thinking, information literacy, collaboration, and lifelong learning. These skills can be fostered through student-centered practices of inquiry, application, production, and problem solving. A school current that flows in that direction, with the necessary tools, resources, and support, can carry teachers and students toward their goals. Teachers who

are swimming against the current cannot be expected to sustain forward progress over time.

Appendix A: Comparison of Means, Did and Did Not Complete Survey 2 (Non-NT)

Table 34

Comparison of Means for Teachers Who Did and Did Not Complete Survey 2 (Non-NT, Time 1 Data)

Measures	Did Not Complete Survey 2 (N = 93)	Did Complete Survey 2 (N = 97)	*t*	*df*
Self-efficacy	80.91 (13.70)	82.16 (11.63)	.67	178
Outcome expectancy	78.20 (14.69)	80.41 (14.95)	1.0	178
Task value	81.15 (13.98)	83.97 (13.41)	1.38	178
Perceptions of school conditions-Teacher participation	2.63 (.66)	2.68 (.72)	.53	175
Perceptions of school conditions-School structures	2.23 (.64)	2.12 (.68)	.56	175

Appendix B: Comparison of Means, Did and Did Not Complete Survey 2 (NT)

Table 35

Comparison of Means for Teachers Who Did and Did Not Complete Survey 2, Time 1 Data (NT)

Measures	Did Not Complete Survey 2 (N = 75)	Did Complete Survey 2 (N = 88)	*t*	*df*
Self-efficacy	82.60 (17.96)	81.16 (13.58)	.63	161
Outcome expectancy	81.36 (17.92)	83.78 (14.43)	.95	161
Task value	88.01 (15.61)	89.72 (12.10)	.78	161
Perceptions of school conditions-Teacher Participation	3.16 (.60)	3.28 (.62)	1.72	161
Perceptions of school conditions-School Structures	3.23 (.74)	3.35 (.66)	1.10	161

Appendix C: Teacher Survey 1

PBL Implementation 2012

1. RESEARCH PROCEDURES

This research is being conducted to explore the role of three motivational beliefs (self-efficacy, outcome expectancy, and task value) and perceptions of school conditions on teachers' classroom implementation of PBL. The survey will take approximately 10 minutes for you to complete. If you agree to participate, click the NEXT button to begin.

RISKS
There are no foreseeable risks for participating in this research.

BENEFITS
There are no direct benefits to you for participating other than to further research on motivational factors related to teachers' implementation of PBL.

CONFIDENTIALITY
The data in this study will be confidential. Once the data from the online survey has been downloaded, any personally identifiable information, such as your name and email address, will be removed from the file and stored in a separate file. A random code will be assigned to your survey responses in one file, and to your personally identifiable information in a separate file. This code will allow the researcher to link survey responses to specific individuals. Only the researcher will have access to the identification key. Please note that data from this study may be shared with other educational institutions. Personally identifiable information will not be shared.

PARTICIPATION AND INCENTIVES
Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

Upon completing the survey, your name will be entered into a drawing to win an iPad. If your name is selected, you will be notified by email. Odds of winning the iPad are estimated to be 1 in 600 for those who complete this survey only. Odds improve for those who also complete a second survey, which will be distributed in November, 2012. At the end of this survey, you will have an opportunity to indicate your interest in participating in the second survey.

CONTACT
This research is being conducted by Mary English, a doctoral student in the College of Education and Human Development at George Mason University. She may be reached at 703-862-0329. The faculty advisor for this project is Dr. Anastasia Kitsantas. She may be reached at (703) 993-2688. You may also contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

Click NEXT to begin.

PBL Implementation 2012

2. Demographic Data All

Please select the options that best describe you.

1. I work at a(n):

- ◯ Elementary school
- ◯ Middle school
- ◯ High school
- ◯ District office
- ◯ State education office
- ◯ College or university
- ◯ Other

2. The name of the school or other organization where I work is:

3. Is your school a New Tech Network school?

- ◯ No
- ◯ Yes

4. The degrees and/or certifications I have completed (check all that apply):

- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Professional degree (EdS, EdD, PhD)
- ☐ Principal's license
- ☐ Other administrator license

5. My current role is:

- ◯ Teacher or faculty member
- ◯ Instructional coach
- ◯ Technology support
- ◯ Classroom aide
- ◯ Administrator
- ◯ Other

Page 2

PBL Implementation 2012

3. Teacher Demographic Data

6. The primary content area that I teach is:

- ◯ All (elementary)
- ◯ English/Language Arts
- ◯ Math
- ◯ Science
- ◯ Social Studies
- ◯ Business
- ◯ Technology
- ◯ Foreign Language
- ◯ Art, music, or physical education
- ◯ Special Education
- ◯ All (elementary)

Other (please specify)

7. I have been a classroom teacher for:

- ◯ Less than 1 year
- ◯ 1-5 years
- ◯ 6-10 years
- ◯ 11-20 years
- ◯ 21-30 years
- ◯ More than 30 years

8. My school/district is considered:

- ◯ Urban/urban fringe
- ◯ Suburban/small city
- ◯ Rural/small town
- ◯ Not applicable

PBL Implementation 2012

9. If you are planning to teach with PBL next semester, what is the PRIMARY reason you are doing this?

- ◯ My school requires it
- ◯ My school doesn't require it, but my school's administrators expect it
- ◯ To join colleagues who have already started using PBL
- ◯ Because it will help my students
- ◯ Because I will enjoy it and/or it will help my career
- ◯ Not applicable or none of the above

Other (please specify)

10. My level of experience with PBL in my classroom and/or school:

- ◯ Beginner
- ◯ Intermediate
- ◯ Leader/advanced

11. My experience learning (as a student) in PBL format before this workshop:

- ◯ Little to none
- ◯ Moderate
- ◯ Extensive

12. During my pre-service education program, the level of instruction I received about PBL or similar methodologies (such as problem-based learning, inquiry-based instruction, discovery learning, etc.) was:

- ◯ None or almost none
- ◯ Some basic information
- ◯ In-depth study

PBL Implementation 2012

13. Other PBL in-service training, professional development, mentoring, and collegial support I received before this workshop:

- ◯ None or almost none
- ◯ Approximately 1-5 days' worth
- ◯ Approximately 6-10 days' worth
- ◯ Approximately 11 or more days' worth

14. When I am taking a class as a student, my preferred way to learn is:

- ◯ Instructor-directed (primarily lecture and reading, with some class discussion)
- ◯ Self-directed and/or collaborative learning (researching problems, creating projects, reflecting, and taking part in extensive class discussion)
- ◯ Neutral or not sure

PBL Implementation 2012

4. PBL Tasks

This set of items is designed to help us gain a better understanding of the kinds of things that create difficulties for teachers when teaching with project-based learning (PBL). Using the scale below, please rate how certain you are that you can do each task listed. Enter a number from 0 to 100.

15. Indicate how certain you are that you can do each task by entering a number from 0 - 100.

0 = Certain I cannot do

100 = Certain I can do

I can create driving questions that are engaging for my students.	
I can create projects that cover the required curriculum at the necessary level of depth.	
I can organize students into groups that facilitate learning.	
I can establish appropriate scaffolds to facilitate student acquisition of content knowledge.	
I can create effective assessments for project work.	
I can teach students self-regulation skills (such as goal setting, self-monitoring, and reflection).	
I can effectively manage class time during PBL.	
I can effectively provide students formative feedback.	
I can guide students to solve their problems rather than giving them the answers.	

PBL Implementation 2012

5. PBL Value

The set of items below is designed to help us gain a better understanding of the level of value you place on PBL. Using the scale below, please rate each item below by entering a number from 1 to 100 for each item.

16. Indicate how strongly you believe each of these statements. Select a number from 0 - 100.

0 = Not at all

100 = Very much so

How much will you enjoy teaching with PBL?	
How rewarding will PBL be for you?	
How satisfying will PBL be for you?	
Is the amount of effort it will take for you to teach with PBL worthwhile to you?	
Is it important to your career to be successful in teaching with PBL?	
Will you be recognized by your school colleagues and administration for your efforts to learn and execute PBL?	
Will you learn new teaching skills by teaching with PBL?	
How useful are the skills that students learn through PBL?	
In order to help your school be successful, is it important for you to be successful with PBL in your classroom?	
How important is PBL to the achievement of most or all of your students?	

PBL Implementation 2012

6. PBL Expectations

This set of items is designed to help us gain a better understanding of what you expect when you execute PBL well in your classroom. Using the scale below, please rate how certain you are that the outcomes listed below will happen when you execute PBL well in your classroom. Enter a number from 1 to 100 for each item.

17. Indicate how certain you are that the things below will happen if PBL is well-executed in your school in the upcoming school year. Select a number from 0 - 100.
0 = Certain this will not happen
100 = Certain this will happen

Most or all students will meet or exceed their current levels of performance and achievement.	
Most or all students will learn to manage their own learning.	
Most or all students will be highly engaged in the learning.	

PBL Implementation 2012

7. Intention to Implement PBL

From the choices listed below, please indicate your plans for practicing PBL in the upcoming semester.

18. Select the choice that most accurately describes what PBL activity(ies) you are committed to.

- ◯ I do not plan to pursue any PBL-related activity during the next semester.
- ◯ I plan to continue formal or informal learning about how to teach with PBL.
- ◯ I plan to create a PBL project plan to be implemented later.
- ◯ I plan to implement one PBL project.
- ◯ I plan to implement two or three PBL projects.
- ◯ I plan to fully adopt PBL in my classroom.

PBL Implementation 2012

8. School Perceptions

19. How often will teachers at your school do each of the following?

	Never or almost never	Sometimes	Frequently	Always or almost always	Not sure
Have instructional coaches and/or "critical friends" visits	◯	◯	◯	◯	◯
Be involved in school leadership, setting policies or making important decisions for the school	◯	◯	◯	◯	◯
Participate in high quality professional development experiences	◯	◯	◯	◯	◯
Collaborate with colleagues to plan and discuss issues	◯	◯	◯	◯	◯

20. How often will these policies and organizational structures be in place at your school?

	Never or almost never	Sometimes	Frequently	Always or almost always	Not sure
A school-wide emphasis on problem-based, project-based, or inquiry learning	◯	◯	◯	◯	◯
Block or flexible scheduling or extended periods for working on projects or other activities	◯	◯	◯	◯	◯
A flexible curriculum to accommodate PBL	◯	◯	◯	◯	◯
School-wide rubrics for assessing student work across different subjects, grades, or courses	◯	◯	◯	◯	◯
A grading policy aligned with PBL	◯	◯	◯	◯	◯
A collaborative project planning and assessment system	◯	◯	◯	◯	◯
Adequate student access to technology	◯	◯	◯	◯	◯
Adequate teacher planning time	◯	◯	◯	◯	◯

PBL Implementation 2012

9. Follow-up

In appreciation for teachers who have completed this first of two surveys, we will be give away one iPad. The winner will be randomly selected from all entries. Your odds of winning are estimated to be approximately 1 in 600. If you would like to be entered into this drawing, please provide your name and contact information below. The iPad winner will be notified by email after the second of two surveys closes in November.

We will be distributing the second survey in November. Everyone who completes that survey will be entered into the drawing a second time, and will also receive a $10 Amazon.com gift card. If you complete the second survey, your odds of winning improve to approximately 1 in 300. The survey will be sent to the email address(es) you provide here.

IMPORTANT NOTE Providing your name or email address will not impact the confidentiality of your survey responses. All survey responses will be stored separately from personally identifiable information.

21. Name:

22. Preferred email address:

23. Alternate email address:

PBL Implementation 2012

10. Thank you

Thank you for completing this survey!

Appendix D: Teacher Survey 1 Flyer

PBL Teachers
Share your Thoughts!

Complete one survey now and another one six months later (10 minutes each) to be entered into a drawing to win an iPad and to receive an Amazon.com gift card.

How Will this Help?

Your input will help eductators understand the teachers' perspective on PBL implementation.

What to Do

1. Complete the online survey (available now) before July 31, 2012. Receive an entry into the iPad drawing.

2. Complete the second online survey when you receive an email in November, 2012. Receive a $10 Amazon.com gift card **and** another entry into the iPad drawing.

PROJECT BASED LEARNING
21st Century Skills • Student-Centered
Collaboration • Technology • Community
Engagement • Deep Learning

https://www.surveymonkey.com/s/PBLimplementation

GEORGE MASON UNIVERSITY

This research is being conducted by Mary C. English, a doctoral candidate in George Mason University's College of Education and Human Development. She may be reached at 703-862-0329. The faculty advisor for this project is Dr. Anastasia Kitsantas. She may be reached at (703) 993-2688. You may also contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

Appendix E: Teacher Survey 2 Flyer

PBL Teachers

Share your Thoughts...Again!

Thank you for completing the first survey over the summer. In appreciation for your time, you have already been entered into a drawing to win an iPad.

Complete this second and final survey to receive a $10 Amazon.com gift card and another entry into the drawing.

How Will this Help?

Your input will help educators understand the teachers' perspective on PBL implementation.

What to Do

1. Look for an email from Mary English of George Mason University on or about November 4, 2012.
2. When you receive the email, follow the link to the online survey. Complete the survey by November 21, 2012 to receive a $10 Amazon.com gift and a second entry into the iPad drawing.

Receiving Your Gift

The Amazon cards will be distributed and the iPad winner will be announced, via email, by December 1, 2012.

PROJECT BASED LEARNING
21st Century Skills • Student-Centered
Collaboration • Technology • Community
Engagement • Deep Learning

GEORGE MASON UNIVERSITY

This research is being conducted by Mary C. English, a doctoral candidate in George Mason University's College of Education and Human Development. She may be reached at 703-862-0329. The faculty advisor for this project is Dr. Anastasia Kitsantas. She may be reached at (703) 993-2688. You may also contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

Appendix F: Teacher Survey 2

1. WELCOME

The following survey is a follow-up to a PBL teacher motivation survey administered in June and July of 2012 to attendees of the PBL Institute (CELL), PBL Academy, and New Tech Network professional development events. If you completed that survey, you are invited to complete this one as well.

On the last page of the survey, you will be prompted to enter your email address. The email address you enter will be used to send your Amazon.com gift card and the iPad prize notification. Please use the same email address where you received the invitation to participate in this survey.

Please note that the gift card and the iPad prize notification will be delivered to the email address you provide by December 1, 2012.

To begin, enter the 3-digit code provided to you in the email invitation to this survey.

1. Please enter the 3-digit code provided to you in the email invitation to this survey.

3-digit Code:

2. RESEARCH PROCEDURES

This research is being conducted to explore the role of three motivational beliefs (self-efficacy, outcome expectancy, and task value) and perceptions of school conditions on teachers' classroom implementation of PBL. The survey will take approximately 15 minutes for you to complete. If you agree to participate, click the NEXT button to begin.

RISKS
There are no foreseeable risks for participating in this research.

BENEFITS
There are no direct benefits to you for participating other than to further research on motivational factors related to teachers' implementation of PBL.

CONFIDENTIALITY
The data in this study will be confidential. Once the data from the online survey has been downloaded, any personally identifiable information, such as your name and email address, will be removed from the file and stored in a separate file. A random code will be assigned to your survey responses in one file, and to your personally identifiable information in a separate file. This code will allow the researcher to link survey responses to specific individuals. Only the researcher will have access to the identification key. Please note that data from this study may be shared with other educational institutions. Personally identifiable information will not be shared.

PARTICIPATION
Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party. After completing the survey, you will receive a $10 Amazon.com gift card (by December 1, 2012) and your name will be entered into a drawing to win an iPad. If your name is selected, you will be notified by email by December 1, 2012. Odds of winning the iPad are estimated to be 1 in 300 for those who complete this survey.

CONTACT
This research is being conducted by Mary English, a doctoral student in the College of Education and Human Development at George Mason University. She may be reached at 703-862-0329. The faculty advisor for this project is Dr. Anastasia Kitsantas. She may be reached at (703) 993-2688. You may also contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

Click NEXT to begin.

3. PBL Tasks

This set of items is designed to help us gain a better understanding of the kinds of things that create difficulties for teachers when teaching with project-based learning (PBL). Using the scale below, please rate how certain you are that you can do each task listed. Enter a number from 0 to 100.

2. Indicate how certain you are that you can do each task by entering a number from 0 - 100.
0 = Certain I cannot do
100 = Certain I can do

I can create driving questions that are engaging for my students.	
I can create projects that cover the required curriculum at the necessary level of depth.	
I can organize students into groups that facilitate learning.	
I can establish appropriate scaffolds to facilitate student acquisition of content knowledge.	
I can create effective assessments for project work.	
I can teach students self-regulation skills (such as goal setting, self-monitoring, and reflection).	
I can effectively manage class time during PBL.	
I can effectively provide students formative feedback.	
I can guide students to solve their problems rather than giving them the answers.	

4. PBL Value

The set of items below is designed to help us gain a better understanding of the level of value you place on PBL. Using the scale below, please rate each item below by entering a number from 1 to 100 for each item.

3. Indicate your response to each of these questions by entering a number from 0 - 100.
0 = Not at all
100 = Very much so

How much will you enjoy teaching with PBL?	
How rewarding will PBL be for you?	
How satisfying will PBL be for you?	
Is the amount of effort it will take for you to teach with PBL worthwhile to you?	
Is it important to your career to be successful in teaching with PBL?	
Will you be recognized by your school colleagues and administration for your efforts to learn and execute PBL?	
Will you learn new teaching skills by teaching with PBL?	
How useful are the skills that students learn through PBL?	
In order to help your school be successful, is it important for you to be successful with PBL in your classroom?	
How important is PBL to the achievement of most or all of your students?	

5. PBL Expectations

This set of items is designed to help us gain a better understanding of what you expect when you execute PBL well in your classroom. Using the scale below, please rate how certain you are that the outcomes listed below will happen when you execute PBL well in your classroom. Enter a number from 1 to 100 for each item.

4. Indicate how certain you are that the things below will happen if PBL is well-executed in your school. Enter a number from 0 - 100.

0 = Certain this will not happen

100 = Certain this will happen

Most or all students will meet or exceed their current levels of performance and achievement.	
Most or all students will learn to manage their own learning.	
Most or all students will be highly engaged in the learning.	

6. PBL Implementation

5. From the choices listed below, please indicate the extent of your PBL implementation so far this semester.

- ○ I have not pursued any PBL-related activity this semester.
- ○ I have continued formal or informal learning about how to teach with PBL.
- ○ I have created a PBL project plan to be implemented later.
- ○ I have implemented one PBL project.
- ○ I have implemented two or three PBL projects.
- ○ I have fully adopted PBL in my classroom.

Comments (optional)

7. PBL Component Implementation Measure

6. This semester, how often did you use the following elements in your teaching?

	Never or almost never	Sometimes	Frequently	Always or almost always
A driving question, essential question, or problem statement to focus the learning.	○	○	○	○
Assessments of students' 21st Century skills, such as teamwork, presentation skills, critical thinking, etc.	○	○	○	○
Activities that required students to find answers to questions through their own research.	○	○	○	○
Rubrics for assessing student work on projects.	○	○	○	○
Student-generated activities or research questions	○	○	○	○
Scaffolds to support student learning	○	○	○	○

Comments (optional)

7. During this semester, how often did your students do the following?

	Never or almost never	Sometimes	Frequently	Always or almost always
Collect, organize and analyze information and data	○	○	○	○
Solve real world problems	○	○	○	○
Work collaboratively in groups	○	○	○	○
Rely on logic, reasoning, and discussions with peers to answer questions	○	○	○	○
Decide how to present what they had learned	○	○	○	○
Demonstrate their learning by developing products and presentations	○	○	○	○
Present evidence to support their ideas or views	○	○	○	○
Develop their own questions or "need to knows"	○	○	○	○
Decide how and where to get the information they needed to answer questions	○	○	○	○
Orally present their work to peers, staff, parents, or others	○	○	○	○
Evaluate or critique other students' work	○	○	○	○
Take responsibility for their own learning	○	○	○	○

Comments (optional)

8. Implementation Factors

8. What factors have facilitated or hindered your implementation of PBL so far this semester?

9. What factors have either contributed to or lessened your motivation to implement PBL so far this semester?

10. What tools, resources, information, or other support do you need to move forward with your PBL implementation?

9. School Perceptions

11. How often have teachers at your school done each of the following so far this semester?

	Never or almost never	Sometimes	Frequently	Always or almost always	Not sure
Have instructional coaches and/or "critical friends" visits	○	○	○	○	○
Be involved in school leadership, setting policies or making important decisions for the school	○	○	○	○	○
Participate in high quality professional development experiences	○	○	○	○	○
Collaborate with colleagues to plan and discuss issues	○	○	○	○	○

Comments (optional)

12. How often have these policies and organizational structures in place at your school so far this semester?

	Never or almost never	Sometimes	Frequently	Always or almost always	Not sure
A school-wide emphasis on problem-based, project-based, or inquiry learning	○	○	○	○	○
Block or flexible scheduling or extended periods for working on projects or other activities	○	○	○	○	○
A flexible curriculum to accommodate PBL	○	○	○	○	○
School-wide rubrics for assessing student work across different subjects, grades, or courses	○	○	○	○	○
A grading policy aligned with PBL	○	○	○	○	○
A collaborative project planning and assessment system	○	○	○	○	○
Adequate student access to technology	○	○	○	○	○
Adequate teacher planning time	○	○	○	○	○

Comments (optional)

13. If you implemented at least one project this semester, please describe the project(s). Please include information such as what the driving question was, what students learned, how they went about learning, what kinds of products they produced, and who else was involved.

10. Follow-up

We are also surveying PBL coaches and lead teachers who work closely with teachers who complete this survey. We would like to learn about their observations of your classroom practices. If you have a PBL coach or lead teacher who is knowledgeable about your classroom practices, and we have your permission to ask that individual about his or her observations of your classroom practices, please provide his or her name and email address.

14. Name of a PBL coach or lead teacher who works closely with you (optional):

15. Coach or lead teacher's email address (optional):

16. The researcher would like to interview some of the teachers who completed this survey. Would you be willing to participate in a telephone or Skype interview lasting 20 to 30 minutes? If you indicate yes, the researcher will follow-up with you via email to schedule a date and time for the interview.

- ○ Yes
- ○ No

Comments (optional)

11. Register for Your Gift and iPad Drawing

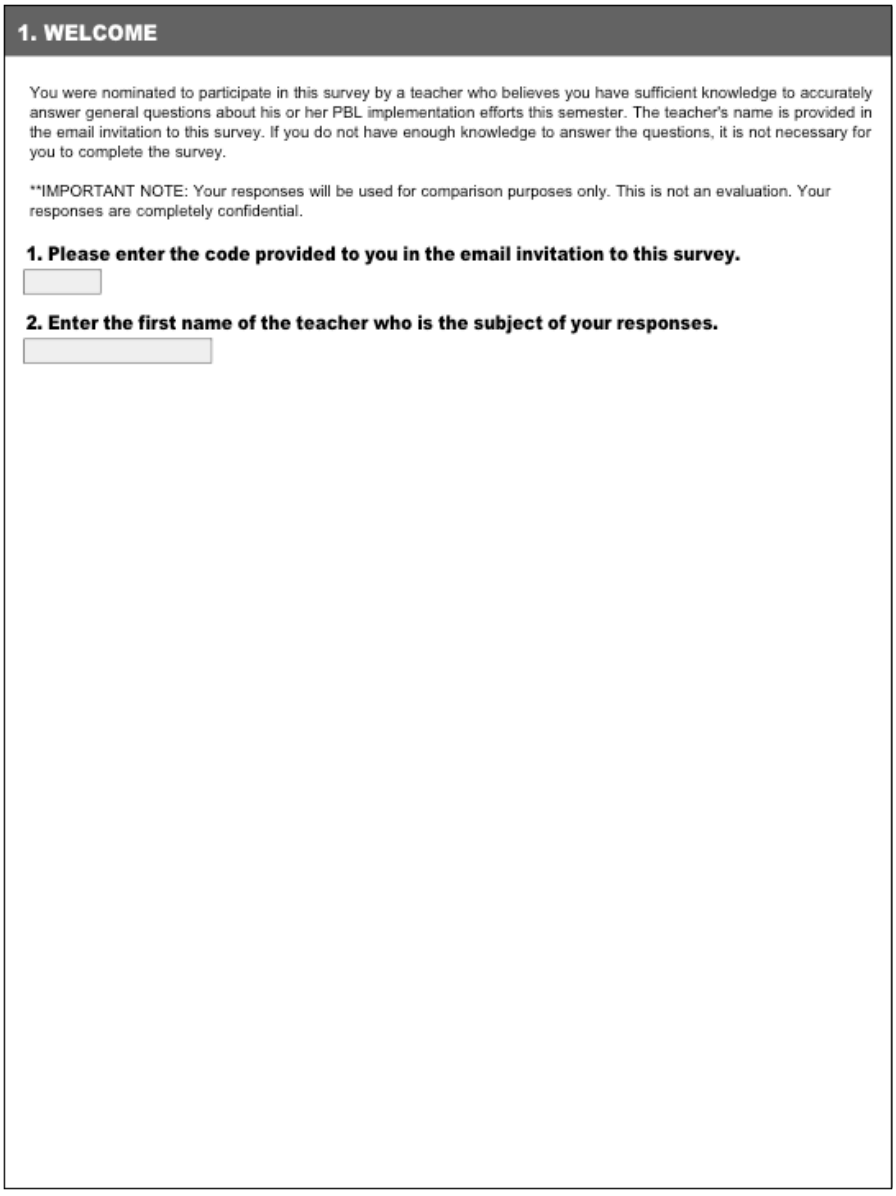
Thank you for completing this survey. In order to receive your $10 Amazon.com gift card, to be entered into the iPad drawing a second time, and to receive the iPad prize notification, please enter your email address below. Please use the same email address where you received the invitation to participate in this survey.

Please note that the gift card and the iPad prize notification will be delivered to the email address you provide by December 1, 2012. If you do not receive the card by December 1, please contact Mary English at menglis2@masonlive.gmu.edu.

IMPORTANT NOTE Providing your name or email address will not impact the confidentiality of your survey responses. All survey responses will be stored separately from personally identifiable information.

17. Enter the same email address where you received the invitation to participate in this survey.

Appendix G: Coach/Teacher Leader Survey



1. WELCOME

You were nominated to participate in this survey by a teacher who believes you have sufficient knowledge to accurately answer general questions about his or her PBL implementation efforts this semester. The teacher's name is provided in the email invitation to this survey. If you do not have enough knowledge to answer the questions, it is not necessary for you to complete the survey.

**IMPORTANT NOTE: Your responses will be used for comparison purposes only. This is not an evaluation. Your responses are completely confidential.

1. Please enter the code provided to you in the email invitation to this survey.

2. Enter the first name of the teacher who is the subject of your responses.

2. RESEARCH PROCEDURES

RESEARCH PROCEDURES
This research is being conducted to explore the role of three motivational beliefs (self-efficacy, outcome expectancy, and task value) and perceptions of school conditions on teachers' classroom implementation of PBL. The survey will take approximately 10 minutes for you to complete. If you agree to participate, click the NEXT button to begin.

RISKS
There are no foreseeable risks for participating in this research.

BENEFITS
There are no direct benefits to you for participating other than to further research on motivational factors related to teachers' implementation of PBL.

CONFIDENTIALITY
The data in this study will be confidential. Once the data from the online survey has been downloaded, any personally identifiable information, such as your name and email address, and that of the teacher you are describing, will be removed from the file and stored in a separate file. A random code will be assigned to your survey responses in one file, and to personally identifiable information in a separate file. Only the researcher will have access to the identification key. Please note that data from this study may be shared with other educational institutions. Personally identifiable information will not be shared.

PARTICIPATION
Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

CONTACT
This research is being conducted by Mary English, a doctoral student in the College of Education and Human Development at George Mason University. She may be reached at 703-862-0329. The faculty advisor for this project is Dr. Anastasia Kitsantas. She may be reached at (703) 993-2688. You may also contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

3. PBL Implementation

3. Based on your knowledge, how would you best describe the extent of PBL implementation achieved so far this semester by the teacher identified in the email survey invitation?

- ○ Has not pursued any PBL-related activity this semester.
- ○ Has continued formal or informal learning about how to teach with PBL.
- ○ Has created a PBL project plan to be implemented later.
- ○ Has implemented one PBL project.
- ○ Has implemented two or three PBL projects.
- ○ Has fully adopted PBL in the classroom.
- ○ I don't know.

Comments (optional)

4. PBL Component Implementation Measure

4. Based on your knowledge, how often has the teacher you named above used the following elements in his or her teaching so far this semester?

	Never or almost never	Sometimes	Frequently	Always or almost always	I don't know
A driving question, essential question, or problem statement to focus the learning.	○	○	○	○	○
Assessments of students' 21st Century skills, such as teamwork, presentation skills, critical thinking, etc.	○	○	○	○	○
Activities that required students to find answers to questions through their own research.	○	○	○	○	○
Rubrics for assessing student work on projects.	○	○	○	○	○
Student-generated activities or research questions	○	○	○	○	○
Scaffolds to support student learning	○	○	○	○	○

Comments (optional)

5. Based on your knowledge of the classroom practices of the teacher you named above, how often have his or her students done the following so far this semester?

	Never or almost never	Sometimes	Frequently	Always or almost always	I don't know
Collect, organize and analyze information and data	○	○	○	○	○
Solve real world problems	○	○	○	○	○
Work collaboratively in groups	○	○	○	○	○
Rely on logic, reasoning, and discussions with peers to answer questions	○	○	○	○	○
Decide how to present what they had learned	○	○	○	○	○
Demonstrate their learning by develop products and presentations	○	○	○	○	○
Present evidence to support their ideas or views	○	○	○	○	○
Develop their own questions or "need to knows"	○	○	○	○	○
Decide how and where to get the information they needed to answer questions	○	○	○	○	○
Orally present their work to peers, staff, parents, or others	○	○	○	○	○
Evaluate or critique other students' work	○	○	○	○	○
Take responsibility for their own learning	○	○	○	○	○

Comments (optional)

5. Factors

6. Based on your knowledge of teachers you work with, what factors do you believe have facilitated or hindered those teachers' implementation of PBL so far this semester?

7. Based on your observations of teachers you work with, what factors do you believe have either contributed to or lessened these teachers' motivation to implement PBL so far this semester?

8. Based on your knowledge of the teachers you work with, what tools, resources, information, or other support do you believe they need to move forward with PBL implementation?

6. Thank You!

Thank you for completing this survey. Your time is greatly appreciated. Your responses will help educators gain a better understanding of the complexities related to teachers' classroom implementation of PBL.

9. Please enter any additional comments here.

Appendix H: Interview Guide

1. What is the extent of PBL activity currently taking place at your school so far this semester?
2. Describe your experience with PBL so far this semester.
3. What do you like or dislike about PBL?
4. What advice would you give to principals regarding how to attain teacher buy-in?

Appendix I: Individual Measures of Motivation, All Teachers (Time 2)

Self-Efficacy Items (Time 2)	Mean (SD)
1. I can create driving questions	84.07 (14.84)
2. I can create projects that cover the required curriculum at the necessary level of depth.	80.70 (15.87)
3. I can organize students into groups that facilitate learning.	84.06 (15.33)
4. I can establish appropriate scaffolds to facilitate student acquisition of content knowledge.	81.61 (16.58)
5. I can create effective assessments for project work.	81.44 (15.37)
6. I can teach students self-regulation skills (such as goal setting, self-monitoring, and reflection).	79.33 (15.86)
7. I can effectively manage class time during PBL.	79.19 (16.99)
8. I can effectively provide students formative feedback.	83.47 (13.59)
9. I can guide students to solve their problems rather than giving them the answers.	82.10 (16.56)
Outcome Expectancy Items (Time 2)	
1. Most or all students will meet or exceed their current levels of performance and achievement.	82.57 (15.84)
2. Most or all students will learn to manage their own learning.	79.38 (17.09)

3. Most or all students will be highly engaged in the learning.	84.19 (14.86)
Task Value Items (Time 2)	
1. How much will you enjoy teaching with PBL?	86.62 (15.29)
2. How rewarding will PBL be for you?	88.33 (14.37)
3. How satisfying will PBL be for you?	87.84 (14.49)
4. Is the amount of effort it will take for you to teach with PBL worthwhile to you?	86.35 (16.65)
5. Is it important to your career to be successful in teaching with PBL?	86.40 (20.22)
6. Will you learn new teaching skills by teaching with PBL?	91.12 (13.06)
7. How useful are the skills that students learn through PBL?	93.02 (11.66)
8. In order to help your school be successful is it important for you to be successful with PBL in your classroom?	89.90 (16.19)

Appendix J: Project Descriptions

We are still working on the following project. Students are researching the following DQ, "How could we as 4th graders encourage others to treat animals more humanely." The project started when we started reading Charlotte's Web at the beginning of October. The book opened the door for discussions on how animals are used and treated. Many of the groups branched off into more specific levels of the topic, for example, one groups is focusing on dog fights and another is focusing on wolves out west. Everyone has chosen to present their information in a science board type poster with the option to incorporate a video or write an article for the school newspaper.

My Seventh graders completed a project on the digestive system. Their driving question was how they would inform a patient that was recently diagnosed with a digestive disorder. The project was two weeks long in order to scaffold the digestive system and how it breaks down nutrients for the body to use. Students completed worksheets and quizzes throughout the weeks and the culminating project was a pamphlet modeled after the ones found in clinics. This project was only done in Science.

Driving question: How do we, as New Tech engineers, use our knowledge of quadratics, trigonometry, and Newton's laws so that we can create an accurate model of the device requested? In this project, students were requested to build a prototype of water balloon launcher for a game show, accompanied by an engineering design proposal. The major standards involved projectile motion and quadratics, and a little bit of trigonometry. We had several labs that let students explore projectile motion and incorporated some activities that gave them lots of practice with graphing quadratics. The project was scaffolded so that students created one section of the proposal at a time (Background Information, Costs and Methodology, Results and Conclusions). Our community partner was the founder of a local engineering firm; he answered student questions about design proposals and gave them feedback on their early versions of their launchers. They tested frequently, and their final test was to attempt to hit our administrator with their water balloon launcher.

Cell Museum. What does it take to make an interactive exhibit for children so that they can learn about the cell? They learned how the parts work and interact with each other. Model, Sign, Podcast. They presented their final product to 5th graders in our district.

Our science / English students designed a cyber cafe for our new school based on research and experiments they conducted as a class. They then had to create a persuasive

presentation to convince the director and the construction supervisor to follow their recommendations. They learned about the scientific method and experimental design. They also learned about specific persuasive strategies.

We are currently covering the American Revolution in which the students are creating a Revolutionary Era newspaper using various article types on various topics. The driving question was: How can media educate the public and sometimes sway public opinion on important current issues? The project is based on the Indiana State Standards. A local journalist came into the classroom and spoke to the students about different types of articles, how to write articles, etc.

How can we present cost effective data to the principal that will persuade her to provide one slice of pizza per student for Taylor Middle School? Students interviewed and collected data from three pizza parlors in the area running a cost analysis of pizza on various toppings, size, and ratio of cost to diameter or pizza. The end product was an excel spreadsheet of data which proved the best buy and cost of pizza for the middle school. Presentation will include representatives from the pizza parlors, principals, superintendent, and parents. Standards covered included manipulating circumference, pi, ratios, unit rates, and cost analysis.

Creek Water Quality. Tested the water and wrote a water quality index report to present to the county commissioners. Driving question: How do we test the water quality of creek to indicate whether cutthroat trout should be introduced. Students learned how to perform water quality tests, learned how to analyze and discuss data and do technical writing. Students performed the testing, analyzed the data, and then wrote individual parts of the paper that were later combined into a group paper. The results were then presented to a panel from the county offices.

We implemented out project -Persuasive poetry. How can poetry influence decisions? Students learned poetic devices and advertising techniques. They met with a radio employee who told them about radio advertising and jingles. The students created jingles for seven local businesses and presented them to a representative from the company.

How can we as game developers design and create a game so that other students can have fun while reviewing math standards? We partnered with another school and at end of project had a big gaming fair with both schools!

Current project Join My Party 2012. How do citizens participate in the political process? Students researched origins of our first political parties and ways citizens can participate in the political process. Students then created their own political party platform and campaign commercial to promote their party which is posted on YouTube and sent to citizens along with a Gallop Poll like survey for feedback.

Students did a project on cancer. The driving question was what causes cancer and how can we cure it. They had to describe the cell cycle and how it gets disrupted, the barriers to treatment, treatment methods, risk factors, etc. they could produce a PowerPoint, keynote presentation, flyer, brochure, poster, tri-fold, poster, etc.

Nutrition Activist or Not? Driving Question: How will my daily lifestyle choices affect me in the future and why should I care? Students were assigned groups and given different sides of a debate to argue in terms of what is the best option for a healthy lifestyle: diet choices only, exercise only, or a combination of the two. Students had to research information on the benefits of a healthy lifestyle and the consequences of an unhealthy lifestyle. They then had to create an opening statement to present during a debate where they defended their argument. Students searched and requested workshops as needed. The assistant principal sat in on the debate, and students took a ballot vote on which group presented the best argument.

Students created an original song and music video to explain the process of the cell cycle. Driving question: How do we as educational songwriters, write a song that explains the cell cycle? The community partner was the Banana Slug String Band out of California. Students were introduced to the project through an entry form for a competition. They created the know/need to know list from this. Students were presented with scaffolded lessons to prepare them to answer the need to know questions. Students were given workshops as needed to create their song and music video using selected websites. Lyrics were composed by the whole group of 4 students in class.

First project was a community health fair- DQ: How can we as 4th graders inform our community about their health? We had over 20 community partners. Students created, researched, and hosted a community health fair. Second project (still working on it) is a culture fair. Learning about the different cultures that are represented in our community.

My co-teacher and I implemented a physical science/English project in which the students helped determine if music should be allowed in the cyber hall being built in our school and what furniture and layout should be in the cyber hall. The driving question was "How can students use scientific methods and persuasive strategies to convince someone to do something?" They worked in groups to design experiments, analyze results, and develop a plan for persuading their director to allow music and the furniture they want. Students learned scientific methods, how to design a fair test experiment, how to write a lab report, how to use persuasive strategies, how to work collaboratively, how to use the computer to make data tables and graphs, and how to use PowerPoint to make a group presentation. They wrote three lab reports on their experiments, a PowerPoint presentation, and a group oral presentation.

Welcome to the Jungle! October 8, 2012 – November 2, 2012. Driving Question: How do teens in rural America lead a healthy, responsible lifestyle through their dietary choices? Hello students of Warren New Tech High School! MTV producers are currently putting

together a new show called "Sixteen & Unhealthy," which seeks to document the nutritional habits of teenagers living in rural areas. We want you to tell us about the things you do and the things that you eat on a daily basis. Through a small sample of our viewership, we have found that most teens could vastly improve their diet, making themselves more healthy and giving themselves more energy. Unfortunately, food resources are often not readily available and teens are not sure exactly what "eating healthy" means. Therefore, this show seeks to educate teens and their parents on healthy and responsible eating. The show will contain three phases: First, each group will provide video documentation of what you eat on a daily basis (at least 3 separate meals) and the activities you partake in on a daily basis (at least 2). The video should be between ten and twenty minutes long. Second, you will research, based on your activities, the nutrition that you need and receive on a daily basis. Third, you will also be asked to find out where some of your current food comes from. Finally, as part of a literacy and education initiative, you will write a research paper exploring possible changes to diet and lifestyle that could give you more energy, but also identifying the many challenges of making these changes as a teenager in a rural community. The research paper will be 4 typed pages in 12-point font.

Students were invited to vend at the Farmer's Market. Sande Hummel, the local manager, invited our students to join two years ago and since that first project it has evolved to involve both 2nd and 4th grades now. We looked at starting a business and how the local economy is impacted by local goods and services. Students started with a know/need to know list and then brainstormed products we could create that involved measurement. Each group broke into committees and created a contract with agreements and due dates. The students created dessert mixes, paper maché bowls, candles, and tie dye t-shirt. They priced their items and created a feedback board for parents, staff, and students to give feedback on original pricing and item improvement for the next year. We use this project to raise money for future projects and materials. This year students raised over $400. They gave change the day to the market to customers and added up total sales between 2nd, 3rd, and 4th grade products.

What does it mean to be a citizen? The immigration project helped the students gain perspective on the immigration process in our country, the number of immigrants (legal/illegal), and legislation concerning immigration in our country. The students created PSAs and flyers. They took practice citizenship tests and researched recent legislation.

We just finished a project that touched on forces and motion. Students were expected to master concepts of distance vs. displacement, speed vs. velocity, acceleration, all of Newton's laws of motion (as well as all relative calculations for each of those concepts), creation of graphs, analyzing graphs, data collection and analysis, and solving one and two-step equations. The learners had to collect data of teen drivers versus other demographics in order to influence a local insurance agency to lower rates for teen drivers. The enduring understanding was if you can accurately collect, analyze, and

display data, you can influence decisions that could directly affect you. In the end the students presented to local insurance agents who partnered with us on the project to influence them to provide reasonable rates to families that have to insure teen drivers. All of our students are freshmen and will be driving within a few years. So they collected data on various driving habits using the science concepts mentioned above such as: driving at unsafe speeds, reaction time in different age groups, distracted driving, stop light decision making, following and braking distance, impaired driving, and high speed impact collisions.

Although somewhat simple within the classroom our driving question was Texting Deal or Ordeal. Has texting affected the ability to effectively use standard English? Students took charge of this and created surveys, our student run radio station was utilized and all classed were involved. SS, ELA, Art etc.

Students selected a car to research in order to find a vehicle that best suits their needs. They created a computer-generated graph to plot the cost of the vehicle over time including its initial cost and the cost of gas per year.

The second project was about US Industrialization. The driving question was: How did a variety of forces assemble to influence the industrialization of the United States? Students worked in teams to create museum-quality displays that demonstrated one part of US Industrialization for an audience of parents and community members who came to view their work on a night at the museum. Products were varied and highly individualized.

Appendix K: Means, NT vs. Non-NT, Individual Items (Time 1)

Table 36

Comparison of Means on Individual Scale Items, NT vs. Non-NT, Time 1

Self-Efficay Items (Time 1)	Non-NT (N = 180)	NT (N = 163)	*t*	*df*
I can create driving questions	84.62 (15.92)	82.88 (16.54)	.99	341
I can create projects that cover the required curriculum at the necessary level of depth.	80.38 (17.02)	79.84 (18.79)	.28	341
I can organize students into groups that facilitate learning.	83.48 (14.82)	84.64 (17.81)	.66	341
I can establish appropriate scaffolds to facilitate student acquisition of content knowledge.	83.47 (14.41)	80.48 (18.03)	1.70	341
I can create effective assessments for project work.	81.59 (15.57)	79.44 (17.51)	1.20	341
I can teach students self-regulation skills (such as goal setting, self-monitoring, and reflection).	77.76 (16.22)	80.26 (17.02)	1.40	341
I can effectively manage class time during PBL.	77.46 (18.08)	81.15 (17.83)	1.90	341
I can effectively provide students formative feedback.	82.86 (13.62)	84.58 (15.96)	1.08	341
I can guide students to solve their problems rather than giving them the answers.	82.66 (14.73)	83.09 (18.57)	.24	341
Outcome Expectancy Items (Time 1)				
Most or all students will meet or exceed their current levels of performance and achievement.	79.73 (15.86)	83.79 (17.71)	2.24*	341

Most or all students will learn to manage their own learning.	75.94 (17.39)	80.09 (19.36)	2.09*	340
Most or all students will be highly engaged in the learning.	82.44 (15.68)	84.11 (15.73)	.98	341
Task Value Items (Time 1)	Non-NT	NT	*t*	*df*
How much will you enjoy teaching with PBL?	83.38 (15.80)	87.61 (16.24)	2.45*	341
How rewarding will PBL be for you?	85.22 (14.81)	89.18 (15.57)	2.42*	341
How satisfying will PBL be for you?	84.96 (14.51)	89.02 (16.06)	2.46*	341
Is the amount of effort it will take for you to teach with PBL worthwhile to you?	82.74 (18.48)	87.55 (17.30)	2.48*	340
Is it important to your career to be successful in teaching with PBL?	80.25 (23.57)	88.66 (20.86)	3.49**	341
Will you learn new teaching skills by teaching with PBL?	87.77 (14.60)	92.14 (16.28)	2.62**	341
How useful are the skills that students learn through PBL?	90.80 (12.04)	94.54 (11.43)	2.95**	341
In order to help your school be successful, is it important for you to be successful with PBL in your classroom?	82.93 (20.09)	94.11 (15.37)	5.74***	341

* $p < .05$ ** $p < .01$ ***$p < .001$

Appendix L: Means, NT vs. Non-NT, Individual Items (Time 2)

Table 37

Means of Individual Scale Items, NT vs. Non-NT, Time 2

Self-Efficay Items (Time 2)	Non-NT (N = 97)	NT (N = 89)	*t*	*df*
I can create driving questions	81.98 (15.95)	82.72 (15.33)	.32	184
I can create projects that cover the required curriculum at the necessary level of depth.	78.84 (19.96)	83.24 (14.61)	1.70	184
I can organize students into groups that facilitate learning.	83.63 (17.56)	86.29 (15.27)	1.10	184
I can establish appropriate scaffolds to facilitate student acquisition of content knowledge.	79.85 (17.49)	81.45 (14.78)	.67	184
I can create effective assessments for project work.	82.23 (14.74)	82.22 (14.25)	.01	184
I can teach students self-regulation skills (such as goal setting, self-monitoring, and reflection).	76.82 (19.49)	77.27 (17.78)	.16	184
I can effectively manage class time during PBL.	78.21 (19.25)	83.73 (14.01)	2.22	184
I can effectively provide students formative feedback.	81.74 (15.28)	83.69 (14.60)	.89	184
I can guide students to solve their problems rather than giving them the answers.	82.69) (16.32)	82.56 (14.85)	.06	184
Outcome Expectancy Items (Time 2)				
Most or all students will meet or exceed their current levels of performance and achievement.	74.92 (17.69)	80.14 (16.47)	2.07*	183
Most or all students will learn to manage	71.54	78.13	2.50*	183

their own learning.	(20.48)	(14.59)		
Most or all students will be highly engaged in the learning.	78.93 (18.41)	80.76 (15.16)	.74	184
Task Value Items (Time 2)				
How much will you enjoy teaching with PBL?	78.49 (21.26)	86.03 (18.67)	2.56*	183
How rewarding will PBL be for you?	79.57 (21.39)	86.25 (17.36)	2.33*	184
How satisfying will PBL be for you?	79.16 (20.16)	85.91 (17.56)	2.42*	184
Is the amount of effort it will take for you to teach with PBL worthwhile to you?	74.18 (22.70)	81.91 (20.73)	2.41*	183
Is it important to your career to be successful in teaching with PBL?	77.80 (22.97)	86.76 (18.34)	2.86*	176
Will you learn new teaching skills by teaching with PBL?	83.07 (19.88)	90.68 (11.81)	3.12**	183
How useful are the skills that students learn through PBL?	85.26 (16.88)	90.96 (11.78)	2.65**	184
In order to help your school be successful, is it important for you to be successful with PBL in your classroom?	75.25 (23.52)	92.76 (15.64)	5.84***	178

* $p < .05$ ** $p < .01$ ***$p < .001$

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CURRICULUM VITAE

Mary English has extensive experience in instructional systems design, online learning design and delivery, interactive media design, and educational media production. She has earned a Bachelor of Arts in Communication from George Mason University and a Master's of Education in Educational Technology from George Mason University. Mary spent eight years as an educational television producer/director for Fairfax County Public Schools. Since then, she has been an instructional design consultant and online teacher and learning specialist for various private, non-profit, government agencies, and educational institutions in the Washington, D.C. area.