SELF AND COLLECTIVE EFFICACY PERCEPTIONS DURING
PROJECT-BASED LEARNING IMPLEMENTATION

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Self and Collective Efficacy Perceptions during
Project-Based Learning Implementation

by

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Project-based learning (PBL) is a teaching method that has the potential to address the Common Core State Standards and 21st Century skills. I described four teachers’ experiences with implementing PBL in middle school science and its effects on teacher self- and collective-efficacy. Pre- and post-implementation administrations of the Science Teachers Efficacy Belief Instrument (STEBI) indicated that teachers’ overall self-efficacy did not change; however teachers experienced moments of changing self-efficacy, and high effort indicated high efficacy. Belief in the ability of the group indicated high collective efficacy. Some of the teachers had to adjust their concepts of teaching and learning. The findings are a call to school leaders to provide collegial support for implementing new curriculum and methods.
DEDICATION

I dedicate this study to my wife, Courtney, and our two amazing children, Andy and Madelyn. I love you more than the world. Thank you for being there, loving me, and being you. We have so much fun together and I look forward to a lifetime of happiness with you. It is hard to imagine that all of this started with a red Skittle.
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I express gratitude to my dissertation chair and committee members. Thank you, Carla, for mentoring, encouraging, and calming me throughout this study. In addition to my family’s support, your confidence in me solidified my decision to join the doctoral program. I am just a small part of the human capital that you have helped create. Dr. Engler, thank you for encouraging my creativity and helping me realize the positive impact that this study has had on students and teachers. Dr. Olive, thank you for keeping me focused on the research process and data, your guidance throughout the program, and helping me realize the importance of data analysis.

I would also like to acknowledge the participants within this case study. I hope that participating in this study will continue to affect your lives and your views on student learning positively. Always push yourselves to do great things for kids. Your stories have changed my life and, hopefully, the lives of others. I thank you.
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CHAPTER I

RESEARCH INTRODUCTION

Introduction

Teachers burn themselves into the memory of their students. Positive and negative experiences with teachers permanently change students, just as positive and negative experiences with students permanently change teachers (Goddard, Hoy, & Hoy, 2000; Guskey & Passaro, 1994; Takahashi, 2011). During my sophomore year in high school, I had an English teacher who gave vocabulary quizzes over words that we never or rarely used in context, relied on textbook grammar, and assigned all reading material. Her classroom lacked student choice and realistic, thought-provoking learning. I will never forget her or the experiences in her classroom. In fifth grade, my teacher allowed us to explore various texts, encouraged us to think outside of subject area boundaries, and took interested students on a weekend field trip to the local newspaper. Learning was interesting, fun, and applicable. I will never forget her or the experiences both inside and outside of her classroom.

Now that I am a teacher, I often think of these two teachers and their dichotomy. What caused them to be so different? Why was one willing to try new things and spend extra time with her students, while the other was going through the motions? Self-efficacy is a person’s belief in his or her ability to perform certain tasks (Bandura, 1977). In my experience with the two teachers described above, I would describe my sophomore
English teacher as having low self-efficacy and my fifth grade teacher as having high self-efficacy.

Research Questions

The focus of this study was to describe the experiences of middle school science teachers who are implementing project-based learning (PBL) and determine the effect of implementing PBL on their self-efficacy. My research questions were (a) How do middle school science teachers experience the implementation of PBL, and (b) How is the implementation of PBL related to perceived teacher self and collective efficacy?

An in-depth study of each teacher’s experiences with PBL and their collective experience was necessary in order to address both research questions. While examining the individual events in each teacher’s PBL implementation process, I sought themes within and between their experiences. Each teacher brought background knowledge and skills that were unique; they had individual biases, beliefs, and values that colored their picture of the PBL process and their efficacy. Through addressing the research questions, I wanted to delve into what makes individuals exceptional and identify the commonalities among the group.

Statement of the Problem

Efficacy is a determining factor of individual and group success. People who are confident in their abilities believe they can make a difference in their lives, other’s lives, and the world (Bandura, 1977, 1993, 1997, 2007; Guskey & Passaro, 1994; Takahashi, 2011; Woolfolk & Hoy, 1990). With the development of the new state science standards
in Ohio, the state is asking teachers to shift the methods they are using to approach student learning. Focusing on creativity, collaboration, problem-solving, and independent learning will be more important than teaching the facts (Achieve, 2012; Ohio Department of Education [ODE], 2011b; Partnership for 21st Century Skills, 2011). The acceptance of the Next Generation Science Standards will further the advance of inquiry-based learning and teaching techniques (Achieve, 2012). Teachers in this study were going through this transition, which affected their practices and, potentially, their efficacies.

Importance of the Study

This study has the potential to impact educational practices, student learning, district professional development, and teacher preparation programs. Middle school science teachers will benefit from the research because they will become aware of perceptions on PBL and teacher efficacy. Kotter and Schlesinger (1979) wrote that resistance to change is overcome through education and understanding the change. The new state standards and the Next Generation Science Standards are a paradigm shift for teachers that will bring uneasiness and confusion. This study will make teachers aware of the change process and the challenges and successes that they will face. Patterns in the data will help teachers understand the nature of implementing PBL, which will lead to the use of PBL in their classrooms. Students will benefit from the generation and development of critical thinking skills, authentic learning, and collaboration.

Districts have the responsibility to provide high quality professional development to their teachers. As the state of Ohio transitions to the new state standards and many states
transition to the Next Generation Science Standards, district leaders face the task of preparing teachers for the changes in pedagogy required to meet these standards. The processes used to implement PBL in this study are universally applicable. Using teacher-leaders to pilot new teaching methods allows them to be an available expert to whom other teachers can go for guidance on the implementation process. District administrators will use the data from this study to develop a greater understanding of teacher efficacy while teachers implement new methods and approaches toward student learning.

Teacher efficacy research is abundant (see Bandura, 1977, 1993, 1997, 2007; Guskey & Passaro, 1994; Takahashi, 2011; Woolfolk & Hoy, 1990) and PBL is a well-documented teaching method (see Buck Institute for Education, 2012; Larmer & Mergendoller, 2011; Mergendoller et al., 2006). There is a gap in the literature, however, concerning current teachers implementing PBL and that implementation’s connection to teachers’ self and collective efficacies. My research has the potential to connect efficacy research to the implementation of PBL and provide insight on the application of teacher self and collective efficacy theory. Highlighting the connection between efficacies and implementing new teacher practices will assist educators in meeting the challenges of our students and ever-changing state and national standards. Providing in depth case studies of PBL implementation will assist in the assessment of teacher efficacy in the implementation process. This research will also add description, stories, and evidence for the present theories on teacher efficacy and provide insight into the implementation of PBL in the middle school science classroom.

Case studies developed from this study will provide pre-service teachers with insight on the teaching profession. Understanding that teachers are learners will help education
students comprehend the demands of our profession. Reading the first-hand experiences of teachers who went through a change process will make them more accepting of change and more likely to attempt new methods of teaching. Pre-service teachers are developing their educational identity; they may empathize, get frustrated, or connect with the teachers in this study.

**My Lens and its Effect on this Study**

**Efficacy background**

During my time as a high school football player, we had signs in the locker room that read, “Whether you think you can or cannot, you are probably right.” Most motivational posters and slogans strike me as simplistic; this one stuck to my psyche. Since I began studying to become a teacher, I have sought methods that captivate my students and enhance their higher-level thinking. The worst thing that I could possibly be as a teacher was boring. Jumping into new ways to approach student learning was something that I enjoyed. I realized early in my career that I would constantly need to change my approach to teaching and learning in order to stay relevant. I agree with efficacy research, which states that high efficacy breeds success (Bandura, 1977, 1993, 1997, 2007; Guskey & Passaro, 1994; Takahashi, 2011; Woolfolk & Hoy, 1990), and I believe that I am an efficacious teacher. The challenge of implementing new methods of teaching is something that I regularly take on. As for other teachers, I believe that, whether they think they can or cannot, they are probably right.
Inquiry background

One of the reasons that I started teaching was because I wanted to destroy the notion that textbooks and worksheets alone lead to student learning. Learning is experiential, hands-on, minds-on, hard work, interesting, and fun. Inquiry-based learning, therefore, fits my personality and philosophy. During inquiry learning, students analyze data, create questions, and investigate phenomena in order to develop a conclusion. Students typically present results, critique classmates’ findings, and synthesize new information with their background knowledge (National Research Council [NRC], 2000). My classroom became progressively more inquiry-based as I moved through my career. I believe that there is room for direct instruction and teacher-led activities, but the majority of learning should be through the means of inquiry. Teachers are facilitators; they create the environment and focus for learning, rather than constantly disseminating knowledge.

PBL background

My first experience with PBL provides insight into my belief in PBL. I attended a two-day training on PBL at our local educational service center and thought it was a wonderful tool to approach student learning. The instructor told us not to try to implement PBL right after the training. He wanted us to take time to develop it and prepare ourselves for the paradigm shift. I took his advice. Instead of implementing PBL right after the two-day training, I implemented it after the first day. PBL was something that I had dabbled in, without knowing what people called it, so I figured I was ready to take it on. I have continued to use PBL as a teaching method. At the time of this study, I had created and completed four PBL projects.
The impact of my lens on this study

My beliefs in the power of efficacy, inquiry-based learning, and PBL will enhance and bias my view of the data. My knowledge of these topics allows me to recognize and analyze them within this study. Because I understand efficacious behavior and the tenets of inquiry and project-based learning, I am able to comprehend the context within which my data exists. I will be able to determine each participant’s concept of PBL, as compared to the research and my experiences. This context will allow me to address my research questions thoroughly, because I will be able to connect efficacy and PBL research to the experiences of each teacher.

During this study, I was on a team that was facing a change in the way we approached teaching and student learning. I had to be a team member, while analyzing individual teachers’ experiences. Going through the same process as the participants allowed me to empathize with them at a deeper level than an outside observer. As seen in Chapter V, I was able to compare my experiences with the cross-case themes. I did consider, however, outside viewpoints when discussing my findings with the focus group that did not otherwise participate in this study.

I believe that I am an efficacious teacher, which can lead me to pre-judge others and compare them to myself. During this study, I had to remain conscious of this tendency in order to analyze the data as it is shown, rather than as I want to see it. My preconceived ideas of teaching and learning, however, colored my view of the teachers’ efficacies within this study.

Inquiry-based learning and PBL have engaged my students and challenged them to think creatively, critically, and collaboratively. I am a believer in inquiry and PBL as
valuable teaching methods and I have an understanding of how they appear in the classroom, based on experience and research. While interviewing and observing teachers during this study, I—consciously and subconsciously—compared the teachers to my constructs of inquiry and PBL. My concepts of inquiry and PBL influenced my thoughts on collected data. In Chapter III, I explained how I addressed my biases and attempted to analyze the data as it is.

**Definitions**

Education and, particularly, science education has its own language. Readers may lack familiarity with some of the vocabulary in this study. Below is a list of words that require further explanation:

*Adequate Yearly Progress*: A student growth measure that is based on subgroups of students meeting state determined proficiency goals. Ethnicity, economic status, and disabilities determine the subgroups (ODE, 2011a).

*Collective efficacy*: A group’s perceptions on their ability to perform certain behaviors that lead to desired outcomes. Collective teacher efficacy would be a teaching staff’s belief in their ability to perform tasks that affect student learning (Bandura, 1997; Goddard et al., 2000).

*Constructivism*: A teaching philosophy that promotes students’ using prior knowledge in order to gain and interpret new knowledge. Students construct learning based on their experiences, rather than passively accumulate facts (Witt & Ulmer, 2010).

*Content standards*: The knowledge and skills that a state expects students to develop at certain levels of their education. “They indicate the ways of thinking, working,
communicating, reasoning and investigating as well as important and enduring ideas, concepts, issues, dilemmas and knowledge essential to the academic area of study” (ODE, 2013a). I will also refer to content standards as state standards and standards within this study.

Inquiry-based learning: A teaching and learning method in which students gain first-hand experience with the nature of a field of study and discover concepts through experimentation, data collection and analysis, and application. Students complete the thought processes and problem solving of a person that is in a specific discipline (NRC, 2000; Leonard & Penick, 2009). For example, a student that is learning about Earth Science will engage in activities or thought-processes that a geologist completes in her daily work or perform experiments that lead to the discovery of Earth Science concepts.

Outcome Expectancy: “A person’s estimate that a given behavior will lead to certain outcomes” (Bandura, 1977, p. 193). Outcome expectancy is also referred to as locus of control.

Project-based learning: Learning that is centered on an open-ended question or product. The question or product provides a reason to understand concepts and develop skills. Students learn content through “critical thinking, problem solving, collaboration, and various forms of communication” (Larmer & Mergendoller, 2010, p. 2). Inquiry and student voice and choice are essential to this type of learning. Teachers emphasize revision and reflection as students deliver products or reports to a public audience (Larmer & Mergendoller, 2010). Project-based learning is also referred to as problem-based learning.
Rubric: A set of expectations for an activity or project. A rubric guides the students as they complete the activity or project and the teacher in assessing student learning. See Appendix A for the rubric used in this study.

Self-efficacy: “The conviction that one can successfully execute the behavior required to produce the outcomes” (Bandura, 1977, p. 193). In this definition, outcomes are the desired consequences of a person’s behavior.

State Report Card: “School and District performance reports, issued annually, detailing students’ performance on standardized statewide tests, rates of improvement on those tests, student attendance and graduation rates” (ODE, 2013b).

Teacher efficacy: “Teachers' belief or conviction that they can influence how well students learn, even those who may be considered difficult or unmotivated” (Gusky & Passaro, 1994, p. 628). This definition is similar to self-efficacy’s definition, except the focus is on teachers’ perceived abilities to affect student learning.

Teaching methods: Approaches that teachers use to affect student learning. Teaching methods determine the type of instruction teachers use to educate students.

Unit of study: A group of lessons focused on a topic. The duration and complexity of the lessons focused on the topic varies. For example, in sixth grade science, cells are a unit of study. Within this unit of study, students explore cell theory, different types of cells, the parts of cells, how cell parts work together, and how cells transfer material. I will also refer to units of study as units.
Value Added: “Value-added analysis is a statistical method that helps educators measure the impact schools and teachers have on students’ academic progress rates from year to year” (Battelle for Kids, 2013).

Summary

In this chapter, I have described my efficacy, beliefs in inquiry and PBL, experiences in education as a student and teacher, and my assumptions as I conduct this research. I also discussed the purpose and problem, and defined words with which readers may be unfamiliar. In the next chapter, I presented the literature on inquiry-based learning, PBL, science standards, and efficacy. I explained the methodology of this study in Chapter III. The teachers in this study implemented a PBL unit with their students as they transitioned to the new state science standards. Within this study, I described the experiences of the teachers involved and sought connections between their self and collective efficacies and the PBL implementation process. I also compared and contrasted the teachers’ experiences in order to develop themes within and between the cases. The experiences of these teachers were described in Chapter IV and analysis is found in Chapter V. This research sought to connect current efficacy research with PBL implementation research—positively affecting current and prospective teachers, administrators, curriculum leaders, students, and the field of education. I discussed conclusions and implications of this study in Chapter VI.
CHAPTER II

REVIEW OF LITERATURE

Introduction

This review of relevant literature is presented in four sections. The first section focuses on constructivism, which is the theoretical framework of this study, and inquiry-based learning. In this section, constructivism and inquiry-based learning are defined, origins are discussed, types of inquiry-based learning used in the classroom are presented, and the effects of inquiry-based learning on student achievement are described. The second section focuses on PBL. In this section, PBL, its connection to inquiry-based learning and science standards, and its effects on student achievement are addressed. The third section focuses on self-efficacy. In this section, self-efficacy is defined, its effects on student and teacher learning are explored, and the consequences of high and low self-efficacy are discussed. The final section focuses on collective efficacy. In this section, collective efficacy is defined, its effects on student achievement and learning environments are described, and its connection to organizational culture is explained.

Constructivism: The Nature of Inquiry-Based Learning

Constructivist theory

Posing questions, determining procedures, analyzing data, and developing and defending conclusions are central functions within scientific inquiry. These aspects of inquiry match the tenets of constructivist theory (National Research Council [NRC],
Constructivist educational philosophy promotes students’ using prior knowledge and prior and current experiences to help them gain new knowledge and develop understanding. Regardless of the type of constructivism practiced, as described below, teachers ask students to engage in the process of learning, rather than being inactive observers. Inquiry-based learning is a toolkit for students to use in order to comprehend science concepts, develop scientific reasoning, and master process skills (Fay & Bretz, 2008; Leonard & Penick, 2009; Meyer & Avery, 2010; Rascoe, 2010; Wilson, 2009). In both constructivism and inquiry-based learning, students personally construct understanding through experience and connection to prior knowledge (Doolittle & Camp, 2003; Witt & Ulmer, 2010).

**Types of constructivism and my alignment with social constructivism**

Constructivism is broken up into three categories: radical, social, and cognitive (Doolittle & Camp, 2003). Radical constructivism focuses on the “internal nature of knowledge” (Doolittle & Camp, 2003, p. 63). There is no external truth to be known. This category of constructivism mirrors the postmodern epistemological belief that reality is constructed through personal experience and “explanations for the way things are in the world are nothing but myths or grand narratives” (Merriam, 2009, p. 10). Social constructivists, on the other hand, believe that knowledge is a social construct, similar to sociocultural perspectives and social cognitive theory (Bandura, 2001; Doolittle & Camp, 2003; Takahashi, 2011). Though interpretivist in nature, social constructivism focuses on communities, rather than individuals. Knowledge adapts around cultural norms, language, and beliefs. My beliefs about learning and teaching align with social
constructivism. As I analyzed data within this study, I considered the experiences and efficacy of each case study participant as part of a broader culture. Though I isolated each case, I was cognizant of the environment in which the cases took place. Cognitive constructivists, the final type, describe knowledge as external, as we are constantly attempting to internalize the external truth of the world (Doolittle & Camp, 2003). This is a positivist approach to education, because cognitive constructivists believe there is a truth out there. Cognitive constructivism, however, has a hint of interpretivism, because people are trying to internalize the outside world (Doolittle & Camp, 2003; Merriam, 2009).

The Benefits and Types of Inquiry-Based Learning

Current research shows that students using inquiry-based learning develop scientific process skills, concept understanding, and content knowledge (Fay & Bretz, 2008; Leonard & Penick, 2009; Meyer & Avery, 2010; Rascoe, 2010; Wilson, 2009). As inquiry is systematically included in science classrooms, students will become engaged in learning. Students become independent and synthesizing learners, when teachers integrate inquiry learning into the curriculum (Fay & Betz, 2008; Leonard & Penick, 2009; Meyer & Avery, 2010; Rascoe, 2010; Wilson, 2009). One example of the benefits of inquiry-based learning was Witt and Ulmer’s (2010) quasi-experimental research study. They found that sixth graders who experienced constructivist, inquiry-based learning had a higher increase between pretest and posttest scores than when they experienced traditional learning. There was a nearly twenty percentage point difference between the two methods for the same group of students.
Fay and Bretz (2008) described three levels of inquiry that teachers can use to gradually increase the amount of inquiry in their classes. In level zero inquiry, teachers provide the problem, necessary steps to solve the problem, and solution. They are merely verifying a known solution. Level one inquiry takes the solution away from level zero inquiry, requiring the students to interpret data in order to find an unknown solution. Level two inquiry involves students in developing a process that attempts to solve a teacher-created problem. They have to decide how data will be collected and analyzed. When using the highest level of inquiry, level three, teachers provide only an experience to the students (i.e. a lab demonstration). The students are responsible for all aspects of the scientific investigation, from problem-creation to solution.

Wilson (2009) described the research that defines the three types of inquiry—open, guided and directed—and described how teachers change traditional lessons into inquiry-based learning. Open inquiry is when students choose every aspect or nearly every aspect of their learning. The questions, process, and display of their learning is completely self-guided; the teacher acts as a facilitator. Wilson’s (2009) open inquiry is similar to Fay and Bretz’s (2008) inquiry level three. Guided inquiry involves teachers setting up experiential situations in which student learning will occur. Teachers use guiding questions and ask students to develop a process of data collection and analysis in which conclusions may vary, similar to Fay and Bretz’s (2008) inquiry level two. Directed inquiry is when students follow a step-by-step procedure and come to predetermined conclusion. Directed inquiry is similar to Fay and Bretz’s (2008) inquiry level zero. Changing a traditional, lecture-based activity into a guided inquiry lesson
involves developing scenarios in which the students’ experiences help them answer “what” and “why” questions (Wilson, 2009).

Identifying the type of inquiry and the amount of inquiry needed in a science classroom is a difficult task (Fay & Bretz, 2008; Leonard & Penick, 2009; Meyer & Avery, 2010; Rascoe, 2010; Wilson, 2009). Fay and Bretz (2008) offered four models for implementing inquiry based learning in science classrooms. All of the models advocate starting with directed inquiry—level zero—and increasing the inquiry as the school year progresses. The models differ in the rate at which inquiry is increased. One model involves a linear progression, with teachers steadily increasing the amount of inquiry as the year goes on. Two of the models involve exponential progression. In one exponential model, teachers increase the inquiry quickly until they reach the highest level of inquiry—open inquiry. In another exponential model, teachers gradually increase the amount of inquiry in their lessons. The last model involves varying the rate of inquiry throughout the year. The NRC (2000) suggested that open inquiry is not always the best route for student learning. Wilson (2009) and the NRC (2000) favor guided inquiry, which provides students with specific learning objectives that they discover through hands-on activities. Varying the amount of inquiry as the school year progresses allows students to experience open inquiry and discovery science while giving them the guidance that they need in order to learn difficult science concepts (Fay & Bretz, 2008; NRC, 2000; Wilson, 2009).
Overcoming Difficulties in Implementing Inquiry-Based Learning

Teachers struggle with implementing inquiry learning when authentic science learning opportunities meet the realities of classroom resources and teacher preparedness. Concepts of inquiry vary from classroom to classroom, even when teachers attempt to apply the same definition (Marshall, Horton, Igo, & Switzer, 2007; Penuel & Gallagher, 2009). Another complaint teachers have against inquiry is the fight to cover content. Teachers feel like the choice between content coverage and inquiry learning is an either-or decision (Marshall et al. 2007). Many researchers, however, argue that teaching and learning content through inquiry practices and focusing on the true meaning of science learning are more beneficial to students and teachers than covering the standards at a base knowledge level (Achieve, 2012; Fay & Bretz, 2008; Marshall et al., 2007; Meyer & Avery, 2010; NRC, 2000, 2012; Wilson, 2009).

Meyer and Avery (2010) outlined two additional problems with inquiry-based learning and three solutions for addressing these problems. The Getting on Board Problem involves the cycle of empirical knowledge and theoretical knowledge that occurs in the scientific community. Teachers struggle to recreate this in the classroom due to students’ lack of background knowledge. The Variability Problem “stems from the need for a real argument” (p. 28). Students need to discover genuine data that leave room for interpretation. Open data are difficult to find in a middle school classroom.

The first of Meyer and Avery’s (2010) solutions, the Protocol Model, involves students learning ways to collect accurate, useful data. This starts out as a typical experiment, where following instructions is more important than data analysis. Through the process of learning how to collect data, students can later apply this knowledge. If
they learn how to find the concentration of salt in a particular solution, for example, they will be able to adjust this method to find other substances’ concentrations in other solutions. The Protocol Model is more than a new skill; it opens up a new way of learning about the world. Students apply this skill to future learning experiences and this skill reduces the Getting on Board Problem, because they are able to learn needed background knowledge and utilize the cycle of scientific investigation.

The Design Challenge Model, a solution to both of the inquiry problems, has students creating a product under specific restrictions or requirements (Meyer & Avery, 2010). Creating the design or product involves learning and applying specific science content. Teachers not only require students to build or design a quality product, but they challenge students to understand why the product is appropriate for the given tasks and how scientific concepts were applied to design the product. The Design Challenge Model is associated with the basic principles of PBL—students design or create a product or develop a solution to a problem, both of which will be evaluated publicly (Larmer & Mergendoller, 2011; Mergendoller et al., 2006). Applying theoretical knowledge addresses the Getting on Board Problem. The Variability Problem is addressed as students create or design their product; they interpret scientific information and data in order to make decisions about their design.

In the Product Testing Model, students recreate natural phenomena in a controlled lab setting (Meyer & Avery, 2010). Students collect data during physical lab experiments and data analysis leads to the evaluation of the product. As the students analyze their data, they may find the need for more experimentation in order to determine the importance of their data. Meyer and Avery (2010) used the example of determining the
best paper towel. Students will have to figure out how to test the durability of the towel and then determine the importance of those data in terms of the paper towel’s price. The Product Testing Model addresses the Getting on Board Problem, because students have to understand the scientific concepts behind their product tests. It also addresses the Variability Problem, because students have to determine the importance of the data and use the data to guide further experimentation.

Meyer and Avery’s (2010) three models assist teachers in connecting data collection to real life variability and students in developing scientific reasoning skills. Adjusting existing lesson plans allows teachers to balance data collection difficulty and their assignment controls on a class-to-class, student-to-student basis. Teachers do not have to reinvent the wheel, just the way that they think about the wheel. These models provide teachers with a balance between directed and guided inquiry within the science classroom, which is the most effective method of teaching scientific inquiry (Meyer & Avery, 2010; NRC, 2000; Wilson, 2009).

**PBL and the Direction of Science Education in Ohio**

**PBL best practices and their connections to inquiry**

PBL is an approach to teaching and learning that is becoming more prevalent as the standards for science education are approaching higher-level thinking skills and application of content knowledge (Buck Institute for Education, 2012; Mergendoller et al., 2006). Students generate questions, conduct research, and display their findings publicly, all of which are a vital in developing 21st Century skills (Buck Institute for
Larmer and Mergendoller (2011) described PBL as the main course, rather than the desert of learning. Instead of teaching content in a traditional method (i.e. lecture, notes, and presentation) and assigning a project at the end, teachers using PBL design the instruction around a driving question and project. Inquiry learning, student choice, content mastery, and the development of 21st century skills are the foundation of PBL. Teachers teach collaboration, technology-use, and communication skills along with content. (Buck Institute for Education, 2012; Larmer & Mergendoller, 2011; Mergendoller et al., 2006).

Inquiry-based learning within PBL provides students an opportunity to interpret data and develop conclusions. As part of developing their project, students generate questions that lead their research into a content topic (Buck Institute for Education, 2012; Larmer & Mergendoller, 2011). The ideas behind Meyer and Avery’s (2010) models of addressing the difficulties of inquiry are embedded within PBL units. Students participating in PBL are asked to draw conclusions based on data, create products within specified constraints, and assess the quality of products, which are all tenets of inquiry-based learning (Buck Institute for Education, 2012; Fay & Bretz, 2008; Larmer & Mergendoller, 2011; Leonard & Penick, 2009; Meyer & Avery, 2010; Rascoe, 2010; Wilson, 2009).

The Next Generation Science Standards

The NRC (2012) recently described the current science standards as inadequate in preparing students for conducting actual science practices. Current standards focus more on content knowledge, rather than a depth of understanding and process skills. These processes should be integrated throughout the science curriculum in order for students to
understand the connections between perceived-separate areas of science (i.e. physical, earth, space, and biological sciences). In *A Framework for K-12 Science Education*, the NRC explained the importance of inquiry learning in science education:

Engaging in the practices of science helps students understand how scientific knowledge develops; such direct involvement gives them an appreciation of the wide range of approaches that are used to investigate, model, and explain the world. Engaging in the practices of engineering likewise helps students understand the work of engineers, as well as the links between engineering and science. Participation in these practices also helps students form an understanding of the crosscutting concepts and disciplinary ideas of science and engineering; moreover, it makes students’ knowledge more meaningful and embeds it more deeply into their worldview.

The actual doing of science or engineering can also pique students’ curiosity, capture their interest, and motivate their continued study; the insights thus gained help them recognize that the work of scientists and engineers is a creative endeavor [5, 6]—one that has deeply affected the world they live in. Students may then recognize that science and engineering can contribute to meeting many of the major challenges that confront society today, such as generating sufficient energy, preventing and treating disease, maintaining supplies of fresh water and food, and addressing climate change. Any education that focuses predominantly on the detailed products of scientific labor—the facts of science—without developing an understanding of how those facts were established or that ignores the many
important applications of science in the world misrepresents science and marginalizes the importance of engineering. (2012, p. 42-43).

Students are in need of not only separate skills and knowledge, the NRC argues, but must combine skills and knowledge into scientific practices in order to have authentic science experiences. This argument for the development of scientific practice coincides with other calls for the implementation of inquiry-based, project-based, and integrated learning (Achieve, 2012; Common Core State Standards Initiative, 2010; NRC, 2000; ODE, 2011b).

The Next Generation Science Standards (NGSS), based on the NRC (2012) report *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*, emphasized the importance of technology and engineering in science curriculum. In schools that implement the NGSS, students will collect and analyze data in order to develop conclusions and communicate results using engineering and technology practices. The NRC, National Science Teachers Association (NSTA), American Academy for the Advancement of Science (AAAS), and Achieve, partners in the creation of the NGSS, are aligning them to the Common Core State Standards (CCSS) being implemented in forty-five of the fifty United States (Common Core State Standards Initiative, 2010). The alignment is part of the NGSS partners’ goal to integrate curriculum across disciplines and increase the amount of higher level thinking skills in science classrooms (Achieve, 2012). Ohio school districts are in the process of implementing ODE’s (2011b) Revised Science Education Standards and Model Curriculum, which include technology, engineering, and cross-curricular learning opportunities. The goals of the NGSS and CCSS align with the goals of ODE’s new
science standards, including the promotion of 21st Century skills, college-readiness, and analytical thought processes (Achieve, 2012; Common Core State Standards Initiative, 2010; ODE, 2011b).

21st Century skills within PBL

The concept of 21st century skills is present within PBL and inquiry-based learning research. Twenty-first century skills involve critical thinking, creativity, collaboration, and communication (Buck Institute for Education, 2012; Partnership for 21st Century Skills, 2011). In order for students to succeed in a technology-focused world, they will need hands-on, applicable skills that go beyond rote knowledge (Achieve, 2012; Buck Institute for Education, 2012; NRC, 2000, 2012; Partnership for 21st Century Skills, 2011). Self-directed learning, which often happens in inquiry-based learning, is dependent upon motivation as well as thought process strategies (Bandura, 1993; NRC, 2000).

Self-Efficacy and Outcome Expectancy: Research and Application

Defining and differentiating between self-efficacy and outcome expectancy

In an early article, Bandura (1977) described efficacy and outcome expectancy as separate constructs. Efficacy is a person’s belief that he can produce certain behaviors that lead to a wanted outcome, while outcome expectancy is the belief that specific behaviors will lead to a wanted outcome. Put another way, outcome expectancy is a belief about a behavior’s value and efficacy is a belief about personal ability to behave in
certain ways. In education, efficacy is when a teacher believes he or she has the ability to develop or use new methods or strategies and outcome expectancy is a teacher’s belief that certain behaviors affect student-learning outcomes. Some researchers suggest combining the ideas of efficacy and outcome expectancy, arguing that one cannot function without the other (Goddard et al., 2000; Tschannen-Moran, Woolfolk, & Hoy, 1998). Efficacy, in their explanation, is teachers’ beliefs that they can implement effective pedagogy and that pedagogy impacts student learning. Teachers with strong efficacy beliefs recognize the struggles of their students and think that they affect student learning (Guskey & Passaro, 1994; Takahashi, 2011).

Although it is clear that there is a connection between self-efficacy and outcome expectancy, Bandura (1977) determined that self-efficacy is a stronger predictor of future behavior than outcome expectancy. People that experience successes, whether personal or vicarious, increase their perceived self-efficacy, leading to an increase in task achievement. Gaining self-efficacy hinges upon a person’s view of his efforts and the environment. Self-efficacy increases as the perceived difficulty of a completed task increases. Bandura (1977) conducted his early research with people who had snake phobias. He gradually showed the people in the treatment group that they could complete tasks with the snakes and their perceived self-efficacy increased significantly. This led to a significant increase in successful posttest behavior. People’s belief that they could complete a task strongly correlated with their completion of the task. Their enhanced self-efficacies in one set of tasks led to greater self-efficacies and successful completion in dissimilar tasks. It was their belief that they could accomplish the task, however,
which led to successful task completion, not their belief that the outcome would be favorable.

Gusky and Passaro (1994, p. 628) defined teacher efficacy as “teachers' belief or conviction that they can influence how well students learn, even those who may be considered difficult or unmotivated.” Their research and ideas reinforce Bandura's (1977, 1993, 1997, 2007) belief that outcome expectations and efficacy expectations are two separate, yet related, constructs. People who believe a certain behavior leads to a certain outcome will not perform that behavior consistently, unless they believe in their ability to perform that behavior (Bandura, 1977, 1993, 1997; Guskey & Passaro, 1994). Some teachers may think that teaching can have a large impact on student learning, but may lack the conviction that they can execute the necessary function in order to enable student success. Other teachers, however, may think that teaching generally fails to affect student learning, but they are exceptional within their field (Guskey & Passaro, 1994).

Guskey and Passaro’s (1994) study involved 289 K-12 teachers from three medium size suburban/rural school districts and 59 pre-service teachers. Their findings upheld the multifaceted approach to efficacy and outcome expectancy (Bandura 1977, 1993, 1997). In their study, certain items on the survey stated, “I can . . .” and others that stated, “Teachers can . . .” They found no significant difference in teachers’ responses to these statements. When teachers responded to the efficacy statements, they considered the profession as a whole and their personal efficacy as the same construct. Instead of a difference between personal efficacy and efficacy of the profession, they found a
difference between perceived internal and external influences. Guskey and Passaro explain it as follows:

The internal versus external distinction identified in this study more accurately represents teachers' perceptions of the strength of different and independent factors. The internal factor appears to represent perceptions of personal influence, power, and impact in teaching and learning situations. Because of the nature of the items in the current scale, these perceptions reflect a perspective that is positive and optimistic. The external factor, on the other hand, relates to perceptions of the influence, power, and impact of elements that lie outside the classroom and, hence, may be beyond the direct control of individual teachers. These elements might include, for example, the particular social, demographic, or economic conditions that affect students' lives. (1994, p. 639).

According to Guskey and Passaro (1994), these findings indicate that teachers can still have strong efficacy beliefs in the face of difficult external circumstances. Additionally, teachers can lack efficacy, regardless of the external situation. The internal and external factors that influence teacher efficacy are related, yet independent. Even when teachers recognize external obstacles, they can be efficacious in their ability to affect student learning and achievement (Guskey & Passaro, 1994; Woolfolk & Hoy, 1990).

“Self-regulation is not an act of will. It is a skill that must be developed” (Bandura, 2007, p. 647). Self-efficacy is more than just possessing rudimentary skills; it involves the implementation of those skills in an appropriate situation, which requires self-regulation. Skills in a particular area are necessary in order to have efficacy in it, but possessing those skills does not lead to the belief that one can perform. People with the
same skill sets often perform at varying degrees of competency. In self-efficacy and self-regulation research, researchers do not ask about participants’ possessed abilities; they ask participants to assess their ability to execute in specific situations (Bandura, 2007). Self-efficacy and self-regulation involve the ability to perform certain behaviors regularly in the face of impediments. Sticking to an exercise routine, for example, when it is raining or work is busy involves self-efficacy and self-regulation. An example of self-efficacy and self-regulation in the classroom would be continuing to focus on inquiry-based learning, even with a limited amount of time to teach the curriculum. People who believe in their self-regulatory efficacy are more likely to persist in the face of difficulty (Bandura, 1997, 2007).

Self-efficacy is a self-process, which "gives meaning and valence to external events" (Bandura, 1993, p. 118). Efficacy beliefs affect motivation, effort, emotions, behavior, goal setting, and learning (Bandura, 1977, 1993). When setting goals, people who have high self-efficacy focus on difficult tasks and visualize positive results, while people who have low self-efficacy focus on easy tasks and visualize failure. Self-doubt makes goal attainment problematic. Skill level may not necessarily equal success in performance. A person’s self-efficacy impacts his ability to perform appropriate tasks, even when his skill level for that task is high. A person with high self-efficacy and intermediate skills can often perform difficult tasks, because he or she is more likely to attribute success to effort. That person will, therefore, put forth more effort than a highly skilled, low efficacious person will. Efficacy also improves people’s abilities to perform in difficult situations. As Bandura (1993, p. 120) stated, “It requires a strong sense of efficacy to
remain task oriented in the face of pressing situational demands and failures that have social repercussions.”

**Self-Efficacy and the Environment**

In a study focused on changing teacher pedagogy, Marshall et al. (2007) surveyed 1,222 elementary, middle school, and high school mathematics and science teachers, about 64% of a southeastern United States school district’s population. They found that, as science teachers’ grade level taught increased, the amount of inquiry and the amount that teachers believed that inquiry should be taught decreased. Outcome expectancy plays a role in these findings, because teachers’ beliefs in the impact of a pedagogy affect their implementation of that pedagogy (Bandura, 1977; Marshall et al., 2007; Tschannen-Moran & Barr, 2004). Marshall et al. (2007) also found that there is a knowing-doing gap between the amount of inquiry taught in science classes and the amount that teachers thought should be taught in science classes. Thompson (2008) described five causes for the knowing-doing gap in individuals and organizations: (a) People talk instead of act, (b) people stop thinking and do what they have always done, (c) action is prevented because of fear, (d) bureaucratic mechanisms prevent change, and (e) competition gets in the way of collaboration. When making a pedagogical change, teachers have to work against one or more of these barriers. Teachers in middle and high schools have increasing pressure to focus on short-term student achievement and standardized tests, leading them to set aside new pedagogy that could positively impact their students’ learning in the long-term because it could hurt their short-term achievement numbers (Marshall et al., 2007).
Shidler (2009) explained that teachers require consistent, supported learning opportunities to develop new skills. Moving at their own pace provides teachers with a sense of control over their own learning. Shidler’s description of adult learning theory mimics Lewin’s concepts of unfreezing and refreezing. Thompson (2008) states that, in Lewin’s change theory, people have to stop their old behaviors—unfreezing—and practice new behaviors—refreezing—in order to make the new behaviors permanent. Teachers who are higher in age can find it difficult to change their current behavior or develop new skills. People who think aging reduces ability are more likely to attribute failures to ability, rather than the situation. Adults achieve more, however, when they believe that skills are learned, rather than inherent (Bandura, 1993). On the subject of inquiry-based learning and teachers who are higher in age, Marshall et al. (2007) found that years of teaching experience does not significantly affect the amount of inquiry usage. Teachers have to understand that great teaching is learned, not inherent, in order to become efficacious in a particular pedagogy (Bandura, 1993). With increased support and practice, efficacy increases and it is more likely that newly learned behaviors and skills become permanent (Bandura, 1977, 1993; Shidler, 2009).

The availability of instructional support and materials positively affect teachers’ efficacy in inquiry-based teaching practices. Curriculum support had a higher correlation with teachers’ use of inquiry in the classroom than with their perceived ideal amount of time using inquiry. With curriculum support, teachers spend more time implementing inquiry. The lessons and materials available to teachers positively correlate to their use of inquiry instruction (Marshall et al., 2007). Penuel and Gallagher (2009) had similar findings when they studied three approaches to inquiry professional development for
Earth Science teachers. Teachers who were involved in lesson creation activities and provided curriculum-focused materials were more likely to implement inquiry-based strategies into their daily activities.

When teachers had access to materials that experts had designed for the purpose of promoting inquiry and exposing students to the nature of science, and when their professional development encouraged them to use those materials in teaching, they were more likely to submit lessons that were judged to be of higher overall quality than were teachers who did not get professional development.

(Penuel & Gallagher, 2009, p. 495)

The ability to provide quality lessons and put forth the effort to develop and teach these lessons is evidence of self-efficacy. Professional development that is sustained and supportive leads to high efficacy and high student achievement (Bandura, 1993; Shidler, 2009).

Efficacy gives people a sense of control over their environment, which affects their emotional states and how they cope with stress (Bandura, 1993). People who think that they can control their stressors have less anxiety and disturbing thought patterns than people who think their stressors are out of control. A perceived lack of stressor control magnifies threats and leads to irrational worries. “Behavior is motivated and guided by cognized goals operating in the present rather than pulled by an unrealized future state” (Bandura, 1993, p. 130). If people think that they can control their current environment to an acceptable degree, then they will be able to cope with difficulties that arise in or because of that environment. People with high self-efficacy have worries and disturbing thoughts, but they also have the ability to control disturbing thought processes and
accurately assess their magnitude. Having low self-efficacy not only affects professional learning, but may also lead to depression (Bandura, 1993).

Feedback and effort determine self-efficacy rather than content knowledge. When people see that they are gaining mastery of a skill, compared to others, their self-efficacy increases. “Performance feedback that focuses on achieved progress underscores personal capabilities. Feedback that focuses on shortfalls highlights personal deficiencies” (Bandura, 1993, p. 125). In a study involving over one thousand K-12 teachers, subject matter content knowledge did not have a significant correlation to the amount of inquiry used in the classroom (Marshall et al., 2007). Marshall et al.’s (2009) finding connects to Swackhamer, Koellner, Basile, and Kimbrough’s (2009) finding that content knowledge did not significantly impact self-efficacy. Efficacious teachers do not need a large amount of content knowledge in order to implement inquiry.

**Self-efficacy within students: Two types of learning beliefs**

Bandura (1993) described two types of learning beliefs that students hold. Functional learning beliefs are when people seek challenge and knowledge expansion, and expect to learn from failures. Learning is about personal improvement. Some children and adults believe that ability comes from inherent intellectual capacities. These students prefer to complete tasks that they know they can achieve and sacrifice learning for perfection. Giving effort indicates a lack of intelligence in their eyes. The type of learning belief that students hold depends on their self-efficacy and the learning environment in which the student functions. Competitive social comparison is when students compare their academic progress to other students as a means of assessing their skills. Self-analysis,
however, involves students comparing their successes and struggles with learning to their previous selves in order to consider their academic growth. Students who are in learning environments that emphasize self-analysis, rather than competitive social comparison, experience self-efficacy and achievement gains. It should be noted, however, that people with high self-efficacy are able to persevere and exercise their control in even the most restrictive environments.

**Qualities of teachers with high and low efficacy**

Teachers with high efficacy put forth greater effort to learn and develop new teaching strategies, exhibit more perseverance in the face of difficulty, and expect more from their students than teachers with low efficacy expect. Low self-efficacy leads to a cycle of futility, where teachers believe that their teaching does not impact students and they stop attempting to reach difficult students. Self-efficacious teachers are more likely to have an open classroom environment, where students develop understanding through exploration and debate, rather than traditional methods of learning. Teachers with high efficacy also have a significant, positive impact on student academic performance. Students in a classroom with a highly efficacious teacher will be more likely to develop skills necessary for life-long learning (Bandura, 1993). “A major goal of formal education should be to equip students with the intellectual tools, self-beliefs, and self-regulatory capabilities to educate themselves throughout their lifetime” (Bandura, 1993, p. 136). Woolfolk and Hoy (1990) found that teachers with low efficacy relied on extrinsic motivators and punishment, while teachers with high efficacy used intrinsic motivators and self-direction to enhance student development.
Inquiry-specific self-efficacy

Teachers that possess a high-level of efficacy in inquiry learning are more likely to use inquiry-based instructional practices in a typical lesson. This finding holds, when controlling for grade level taught and subject taught—science or mathematics, which means that inquiry has cross-curricular applications (Marshall et al., 2007; NRC, 2012). Content and pedagogical knowledge training is not sufficient, if the self-efficacy beliefs are not reinforced. Teachers need consistent support in the classroom as they implement inquiry learning (Marshall et al, 2007).

Efficacy and resistance to change

Efficacy plays a role in recognizing and addressing change resistance. According to social cognitive theory, people are agents that intentionally change the world around them. They plan, self-regulate, and self-reflect in order to reach desired outcomes (Bandura, 2001). When people are going through a change process, such as implementing PBL, they may feel resistant to change and seek the desirable outcome of keeping their behavior consistent with their current beliefs. New learning within an organization creates tension and invites resistance to change (Bandura, 2001; Coutu, 2002; Kotter & Schlesinger, 1979). As mentioned previously, people with low self-efficacy are less likely to put forth effort than people with high efficacy (Bandura, 1977, 1997). This lack of effort may be perceived as resistance to change. Kotter and Schlesinger (1979) explain that misunderstanding, fear, a low tolerance for change, anxiety, and self-interest lead to change resistance. When people are displaying signs of low self-efficacy, leaders can provide education, communication, support, participation in
the process, and negotiation in order to promote organizational and individual change (Kotter & Schlesinger, 1979).

In *The Anxiety of Learning*, Coutu (2002) described a paradox in which anxiety inhibits learning, yet is necessary for learning to occur. In order for efficacy to remain high or increase, leaders need to give people the education needed to perform new tasks and the opportunity to apply new learning in a supportive setting (Bandura 1977, 1997; Kotter & Schlesinger, 1979). A creative, open learning environment has enough anxiety that members realize a sense of urgency, yet are not too anxious to exchange ideas (Coutu, 2002).

Teachers need to drop their traditional tools in order to discover new ways of approaching student learning. A level of comfort builds within teachers, making them hold on to outdated lesson plans (Simplicio, 2000). Weick (2007) encouraged the concept of “dropping tools” when people or organizations are confronted with situations that they have not confronted before. Increasing people’s efficacies toward change encourages them to drop their typically used tools in order to gain new knowledge and skills (Bandura, 1993, 1997; Weick, 2007).

**Self-efficacy and outcome expectancy conclusion**

High efficacy and outcome expectancy are linked to effort, while low efficacy and outcome expectancy are linked to complacency (Bandura, 1977, 1993). Efficacious teachers believe that their instruction affects student outcomes and they are able to learn effective methods of teaching. Students in classrooms with a teacher that has high
efficacy are more likely to be challenged and expected to perform. Challenge and expectations lead to enriched learning environments and better test results.

**Social Cognitive Theory and Collective Efficacy**

**Social cognitive theory and agency**

Bandura (2001) described social cognitive theory as a way in which people affect and are affected by their social and physical environments. People’s actions and their environments are a product of individual and collective agentic actions. Being an agent means that a person intentionally affects the world around them. “To use Bunge’s (1977) analogy, unique emergent properties of water, such as fluidity, viscosity, and transparency are not simply the aggregate properties of its microcomponents of oxygen and hydrogen. Through their interactive effects they are transformed into new phenomena” (Bandura, 2001, p. 4). Humans are social beings and their interactions change the way individuals behave and think about the world. In a school or district environment, teachers sharing ideas and collaborating in order to develop best practices is an example of building human capital and a way to increase collective efficacy (Bandura, 1993; Keeley, 2007).

**Collective efficacy’s effects on individuals and education**

Efficacy is not created in a bubble; it is a social construct in which the environment plays as much of a role as the belief in oneself (Bandura, 2001; Tschannen-Moran & Barr, 2004). As Takahashi (2011) found, teachers do not develop efficacy based solely
on their own abilities. They also consider the amount of support in their environment and the difficulty of the task. The sociocultural perspective of teacher efficacy includes teachers’ assessments of organizational culture and their place within that culture (Bandura, 2001; Takahashi, 2011). As Bandura (2001, p. 11) stated, “Organizations have to be fast learners and continuously innovative to survive and prosper under rapidly changing technologies and global marketplaces. They face the paradox of preparing for change at the height of success. Slow changers become big losers.” Although it is understood that schools and districts are not a marketplace, Bandura’s (2001) statement exemplifies collective efficacy. Efficacious staffs are willing to change and challenge themselves and their students in order to achieve, even when they have already experienced success (Bandura, 1993, 2001; Goddard et al., 2000).

Goddard et al. (2000) developed the Collective Teacher Efficacy Scale in their study on the correlation between student achievement and collective teacher efficacy. Reading/mathematics achievement test scores were positively correlated with collective teacher efficacy. They found that “a one unit increase in a school's collective teacher efficacy scale score is associated with an 8.62 point average gain in student mathematics achievement and an 8.49 point average gain in reading achievement.” (p. 501). The effects of collective teacher efficacy outweighed the effects of race and socioeconomic status. Goddard, Hoy, and Hoy’s research provided further evidence for Bandura’s (1993, 2001) conclusions about collective teacher efficacy. School staffs that have high collective teacher efficacy are more likely to be persistent and confident in their education of a child. They believe that they can overcome environmental issues in the process of helping students learn (Goddard et al., 2000).
Collective efficacy positively impacts student learning (Bandura, 1993). When school staffs believe in their ability to impact student learning, they create school environments focused on student empowerment, community and personal responsibility, and high achievement. Collective efficacy of a staff determines the environment of a building. In an experiment in Virginia, Tschannen-Moran, and Barr (2004) found that students in schools with high collective efficacy were more likely to improve their standardized test scores than students in schools with low collective efficacy teachers. The effect of collective efficacy in this study overshadowed the effect of socioeconomic status on the eighth grade writing assessment. Students, therefore, believe they can learn when they are in an environment in which learning is expected. As Bandura (1977) discovered, people perform when they have the confidence to perform. Teachers with high self-efficacy produce students with high self-efficacy who put forth the necessary effort to learn difficult concepts. Staffs with high collective efficacy create an uplifting environment, while staffs with low collective efficacy create a powerless environment for students and themselves (Bandura, 1993, 2001). Low student socioeconomic status, high student absenteeism, and high student turnover rates decrease the perceived collective efficacy of a staff. Most of these conditions are found in our nation’s poorest schools (Bandura, 1993). When efficacious teachers affect parent and student involvement in learning, collective efficacy becomes a form of social efficacy. Bandura (1993) described people with social efficacy as being able to seek and build relationships that help reduce the impact of stressors. A staff that builds professional and personal relationships reduces each other’s stress and, therefore, empower efficacy-building.
People have to rely on others to get things done, because they cannot perform all desired functions without help. “Perceived collective efficacy is an emergent group-level property, not simply the sum of the efficacy beliefs of individual members” (Bandura, 2001, p. 14). It cannot be forgotten, however, that individuals are the thinkers and actors; there is no centralized thought. People having high self-efficacy do not necessarily have high collective efficacy. Self-efficacy is part of collective efficacy, but it is not the whole. Some argue that self-efficacy is connected to individualism and self-centeredness. Bandura (2001) refuted this idea, however, stating that high self-efficacy leads to communal actions. He described the story of Gandhi, who believed he had the power to change his environment. His actions changed other people’s lives for the better. High self-efficacy in individual group members, therefore, contributes to collective efficacy. As individual members come to believe in each other’s abilities, collective efficacy increases. Stronger perceived collective efficacy leads to a group having high effort, motivation, morale, and resilience; they persevere in the face of resistance and perform at high levels (Bandura, 2001).

Summary

This review of relevant literature started with an explanation of inquiry-based learning and its connection to constructivist educational philosophy. The second section of the literature review addressed PBL and the current state of science education. NGSS, CCSS, and 21st Century skills are the focus of science education policy. The third section described self-efficacy theory and its implications on teacher effectiveness and student achievement. Highly efficacious teachers are more effective, motivated, and driven than
teachers with low efficacy. The fourth section explained social cognitive theory and collective efficacy. Teachers are parts of groups, schools, districts, and systems. Efficacy cannot be considered without context.

Theories and concepts from this literature review informed my research. Understanding inquiry and PBL allowed me to recognize best practices exhibited in the classroom. The NGSS, CCSS, and 21st Century skills are the goals of current science educational practices. In my research, I was able to uncover how well teachers in this study were prepared to meet these goals. Self and collective efficacies are strong predictors of teacher and student success. While conducting my research, I was the instrument through which my data flowed. This literature review prepared me to recognize the evidence of self and collective efficacies and the factors that contribute to, or take away from, them.
CHAPTER III

METHODOLOGY

Phenomenological Case Study Methodology

Many authors have described case studies as unique within qualitative research (see Creswell, 2007, 2008; Merriam, 2009; Stake, 2005; Yin, 2012), while others have refuted its existence as a methodology—stating that it is merely a form of data collection (see Hesse-Biber & Leavy, 2011). Although I agree with Hesse-Biber and Leavy’s (2011) observation that other qualitative philosophies underpin case study research (i.e. ethnography and phenomenology), case study research has its own methodological characteristics. The commonality throughout authors’ definitions of case study is that they are a bounded system. A case could be a person, group of people, an organization, or event, and a clear boundary exists within which the case is found (Creswell, 2007, 2008; Merriam, 2009; Stake, 2005; Yin, 2012). Creswell (2008) described a bounded case as being “separated out for research in terms of time, place, or some physical boundaries” (p. 476). A combination of phenomenology and case study made sense for this study, because a purely phenomenological study would attempt to recognize the broad essence of a phenomenon, whenever and wherever it occurs. The case study aspect of this research added a focus on the experiences of a particular person, group, or event. Stake (2005) added that “the purpose of a case report is not to represent the world, but to represent the case” (p. 460). My research sheds light on the experience of implementing a new teaching method within specific cases.
Researchers using phenomenology focus on the lived experiences of the people involved in a study (Guest, Namey, & Mitchell, 2013; Van Manen, 1990). In my research, a series of case studies have been performed with four science teachers who implemented PBL as a new teaching method—the phenomenon which all experienced. As Guest et al. (2013) described, “much qualitative research is phenomenological in nature in that it attempts to understand individuals’ lived experiences and the behavioral, emotive, and social meanings that these experiences have for them” (p. 10-11). The difference between phenomenology and other types of research is that it focuses on the pre-reflective world. Researchers attempt to display events as they are experienced, rather than putting experiences into pre-supposed categories (Van Manen, 1990).

**Justification for Using Phenomenological Case Study Methodology**

Phenomenological case study was my research methodology because teacher experiences serve as the study’s backbone. I have displayed the complexity of those experiences in order to understand the teachers’ perspectives. The participants, individually and as a group, as they implemented PBL in middle school science at a large suburban school district, are the cases—the bounded system. As stated in Chapter I, the purpose of my research was to describe and understand teachers’ experiences while trying a new teaching method and the impact it had on the participating teachers’ self and collective efficacies. Phenomenological case study methodology matched the purpose of my research, because I sought rich descriptions of life events and how those events impacted teacher efficacy. In case study research, researchers pose questions to participants in order to get them to reflect on their current experience, how it relates to
their previous experiences, and how it affects their lives. Case study and phenomenological researchers also look for an honest and accurate description of occurrences within people’s lives (Creswell, 2008; Guest, Namey, & Mitchell, 2013; Merriam, 2009; Van Manen, 1990; Yin, 2012). These aspects of case studies demonstrate this methodology’s usefulness in addressing my research questions.

Phenomenological case study was a useful methodology in this study, because all of the participants were experiencing the same phenomenon—implementing PBL. The nature of phenomenology and case study research is to probe into the experiences, thoughts, and emotions of people during a selected portion of their life and see events through their lens (Creswell, 2007, 2008; Hesse-Biber & Leavy, 2011; Guest et al., 2013; Merriam, 2009; Stake, 2005; Yin, 2012). In the process of developing these case studies, I also recognized connections between the participants and the phenomenon. One purpose of phenomenology is to capture the essence of an event (Merriam, 2009) and to describe lived experiences through the eyes of the people who have lived them (Guest et al., 2013). Phenomenological case study was the primary methodology used in this study, because my objective was a rich description of teachers’ experiences while using a new teaching method and the impact it had on their efficacies.

**Phenomenological Case Study Research Strengths**

The most prominent strength of a case study lies in its paradoxically focused and holistic nature. Researchers choose case studies for specific, in-depth analysis of a bounded system (Creswell, 2007, 2008; Merriam, 2009; Yin, 2012). Staying focused on the case leads to a greater understanding of the data, as researchers search for meaning
and connections behind peoples’ behaviors and thoughts. Case studies provide insight into a particular part of peoples’ lives within a particular setting. Though case study involves a bounded system, it also promotes the understanding of the cases within a larger structure. Phenomenological case studies may also uncover the essence of a common experience—the big picture of a life event (Guest et al., 2013; Merriam, 2009; Van Manen, 1990). The holistic mentality of case study researchers allows them to recognize the multiple variables that affect authentic social situations (Merriam, 2009). Researchers performing case studies have to realize the social setting of the case, while holding the case separate from that setting. Phenomenology researchers must also hold their prior knowledge and pre-conceived categories separate from the participants’ experiences (Guest et al., 2013; Van Manen, 1990). This is challenging, yet adds weight to the research findings in terms of trustworthiness and applicability. In addition to looking for themes in cross-case analyses, case study researchers hone in on the uniqueness of each case, just as phenomenology researchers hone in on the essence of experience. Neither outliers nor trends are lost in phenomenological case study research.

The focus of phenomenological case studies lead to their second strength: thick, rich description. In a case study, readers get the feel of living through the experiences of the research participants. They understand the human side of research, because case studies invite the reader into the lives and minds of the people involved. Merriam (2009, p. 43) described thick description as an anthropology term that “means the complete literal description of the incident or entity being investigated.” Although experimental studies lend themselves to greater generalizability, they lack the vital quality of understanding the story behind the numbers. Not everyone fits into trends and correlational coefficients.
Phenomenological case studies provide an in-depth look into the decisions and life processes that outline and underscore the human condition and create a connection between the researcher, participants, and reader.

The final strength of phenomenological case study research discussed in this dissertation is the power of the reader. The reader interprets case data and the researcher’s analysis in order to determine its applicability (Merriam, 2009). Case studies bring up questions in the readers mind: “What can I do with these data,” “Why did the people in the case study behave in a certain way,” and “How are these cases connected?” Readers concepts of social situations are expanded and they “determine what can apply to their context” (Merriam, 2009, p. 51). When someone is attempting to apply phenomenological case study research, he or she must consider the setting in which he or she is applying it. Hesse-Biber and Leavy (2011) called this naturalistic generalization, which involves readers seeing their situation within the case study. The dichotomous specific-holistic nature of case studies allow readers to consider the larger system in which the bounded system is placed and apply it to particular situations that make sense to the reader.

**Challenges of Phenomenological Case Study Methodology**

The challenges associated with phenomenological case study research lie in its strengths. All of the descriptive observation falls on the researchers’ shoulders. The researcher is the primary instrument, presenting and analyzing the data while bracketing his bias. They should make biases clear to the reader (Merriam, 2009). Creswell (2008) described researcher reflexivity as the researcher’s awareness of his role and how his
experiences shape his interpretation of the study. In order to overcome the weakness that was my biases, I made my experiences and thoughts about PBL clear and described my sense of efficacy in Chapter I. In Chapter II, I also expressed my alignment with social constructivism. I believe that people develop knowledge through and within social constructs, which allowed me to consider the broader context of the individual cases. In Chapter VI, I describe the limitations to this study and the potential for bias, because of my proximity to the case study teachers. In addition to reflexivity, I practiced member checking and peer examination. Member checking involves asking the participants to assess the researcher’s emerging findings (Creswell, 2008; Merriam, 2009; Yin, 2012). I shared my research analysis with individual case study teachers and the group in order to guide my interpretation of the data. This kept me grounded in the data and steered me away from biased, predetermined conclusions. Peer examination involves a peer group or committee, who is knowledgeable about the topic, reviewing the research conclusions (Merriam, 2009). My dissertation committee helped prevent unsubstantiated assertions and ensured that data back up my results.

Participants may not be conscious of their lived experiences as they are experiencing them. Van Manen (1990) described this as a reality of phenomenological research and gave the example of a person trying to explain his anger while he is angry. Once the person begins to analyze his anger, the anger has changed or dissipated. It was a challenge to gather accurate experiences from the teachers in my study, because they were describing the implementation of PBL as they were experiencing it. As Van Manen (1990) stated, “Phenomenological reflection is not introspective but retrospective. Reflection on lived experience is always recollective; it is reflection on experience that is
already passed or lived through” (p. 10). The teachers in my study described experiences as they remembered them and as they perceived them.

Merriam (2009) explained that the large amount of data from a case study can overwhelm practitioners, policy makers, and the researcher. The rich, thick descriptions that make a case study valuable often turn an audience away, because the data are incomprehensible. Stake (2005) suggested that researchers consider the audience when reporting case study results, including how much information to report, how to report this information, and how much interpretation to leave to the reader. In writing my dissertation, I offered readers the information that is pertinent to their potential application of the data. The reader will decide its applicability, but I created a clear picture of the PBL implementation process and its potential effects on efficacy.

**Setting**

This study took place in three middle schools within a large suburban school district in Ohio. The schools within the district ranged in size from 700 students to just over 900 students. ODE designated all three schools excellent on the 2011-2012 Ohio State Report Card. One of the middle schools met Adequate Yearly Progress and all of the middle schools either met or were above acceptable Value-Added Measures. The suburb was considered middle to upper middle class, yet there was an increasing population of economically disadvantaged students. The three middle schools ranged from 20.5 to 46.2 in percentage of students considered economically disadvantaged. There were various races and nationalities at each school, but White students were the majority in each school. Each school had English Language Learners (ELLs), ranging in percentage from
2.3 to 9.7, that were mostly from African and Hispanic countries (ODE, 2012a, 2012b, 2012c, 2012d).

The majority of students in the middle schools attended two types of science courses: heterogeneous and advanced. Students were selected to be in advanced classes using standardized and gifted assessment results, teacher recommendations, and parent input. Heterogeneous classes had students with a range of abilities, including students with disabilities and English language learners. The case study teachers had mostly heterogeneous classes. Three of them taught advanced classes at some point in the day.

**Participants**

Four middle school science teachers participated in the case studies. Table 3.1 provides demographic information about the participant teachers. All of the teachers taught sixth grade students. As shown in Table 3.1, three of the teachers were female; one of the teachers was male. The overall years of experience for the teachers ranged from five to eleven, and years teaching science ranged from four to eight. The teachers involved were in the process of implementing PBL in their classrooms and I supported the teachers as they implemented PBL.

Table 3.1

**Case study participant teacher demographic information**

<table>
<thead>
<tr>
<th>Teacher pseudonym</th>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Years teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>44</td>
<td>Male</td>
<td>Caucasian</td>
<td>5</td>
</tr>
<tr>
<td>Peggy</td>
<td>33</td>
<td>Female</td>
<td>African American</td>
<td>11</td>
</tr>
<tr>
<td>Marcy</td>
<td>28</td>
<td>Female</td>
<td>Caucasian</td>
<td>7</td>
</tr>
<tr>
<td>Kelly</td>
<td>27</td>
<td>Female</td>
<td>Caucasian</td>
<td>5</td>
</tr>
</tbody>
</table>
Rather than taking a random sample from teachers using PBL, I used a convenience sample of teachers from one suburban school district. The teachers were chosen to participate in this study, because they were teaching a science PBL unit, trusted me to observe and assist them while teaching PBL, and had little to no experience with PBL. Our district’s curriculum coach helped me recruit teachers who she and I believed would be candid in their responses. The small sample allowed me to reach further into the experience of the teachers involved in the study than a large sample. At the time of the study, these teachers were planning, implementing, and reflecting on a PBL unit.

I surveyed the entire department using the Science Teacher Efficacy Belief Instrument (STEBI) in order to compare my participants’ efficacies to the larger group (see the Instrumentation section below). Eleven out of twenty-seven district middle school science teachers, outside of the case study group, responded to the survey. After collecting data from the four main participants, I formed a focus group of four additional middle school science teachers whom I did not interview or observe in the initial study. The focus group provided feedback on the data and analysis that I compiled from the four case study participants. More information regarding the focus group is provided below.

**Informed Consent and Confidentiality**

The Human Subjects Review Board (HSRB) at Ashland University accepted the research proposal for this study. In accordance with the HSRB proposal, all participants were given a written explanation of their role in this study. Teachers in the initial case studies and culminating focus group signed a written consent form (See Appendix B). The consent form outlined all of the necessary information required by the HSRB.
Teachers who only completed the STEBI were given a written explanation of the STEBI’s purpose and their right to abstain from completing the STEBI (See Appendix C).

Names and personal identifiers were withheld from this dissertation. Teachers and people whom the teachers mention in interviews have pseudonyms, and teachers—outside of the initial four—taking the STEBI will be anonymous. Interview data were saved on a digital recorder, a password-protected laptop, and a backup hard drive. When I saved digital recorder data on to my laptop and backup hard drive, interview data were deleted from the digital recorder. A professional transcriber transcribed the interviews using word processing software. The transcriber had no knowledge of the study participants and she deleted audio recordings immediately after each transcription. Observation and demographic data sheets were saved on my laptop. Lesson plans, teachers’ notes, and activities were kept in hard copy and digital form. Results from the STEBI survey were stored using an online survey instrument. Once my research was completed, all hard copy data were returned to the owner or shredded. Once my dissertation was written and approved, all audio recordings and digital data were deleted. The raw data were not stored past the required 36 months.

**Data Collection and Research Procedures**

Data collection consisted of an efficacy belief instrument, multiple observations, interviews, document analyses, and focus groups over a course of three months. The type and amount of data depended on a teacher’s level of participation (see Table 3.2). Teachers who were being interviewed and observed filled out the STEBI before our first
interview and after our last interview. The STEBI provided a snapshot of their perceived self-efficacy in teaching science.

**Instrumentation**

Riggs and Enochs (1990) developed the STEBI based on Bandura’s research on self-efficacy. Teachers answered questions on a five-point Lickert scale, with responses ranging from strongly agree to strongly disagree. As Riggs and Enochs (1990) prescribed, I scored individual STEBI statements differently based on whether they are positive or negative. For positive statements, strongly agree is given the score of five, agree is given a score of four, and so on. An example of a positive statement is, “I am continually finding better ways to teach science.” For negative statements, strongly disagree is given a score of five, disagree is given a score of four, and so on. An example of a negative statement is, “Even when I try very hard, I don’t teach science well.” I compared case study participants’ total pre- and post-PBL scores, as well as differences between pre- and post-PBL scores on individual statements. The case study participants’ total and individual statement scores were also compared with non-case study participants’ scores (see Tables 5.2 and 5.4).

Most of the items on the STEBI remained unaltered. I did change items, however, to represent middle school teachers—i.e. replacing the word “elementary” with the words “middle school.” See Appendix D for the STEBI version used in this study. Though it was originally created for elementary school teachers, the STEBI has been used successfully in middle school settings (see Swackhamer, Koellner, Basile, & Kimbrough, 2009).
Interviews

Three twenty-minute interviews with the four case study teachers took place prior to their implementation of PBL. One of the case study teachers, Kelly, was only able to complete two interviews, because of family obligations. In the initial interviews, I focused on teachers’ beliefs about PBL, the preparation that they had prior to teaching a PBL unit, and their efficacy toward implementing new teaching methods. Each teacher participated in two half-hour post-observation PBL interviews—after they taught the PBL unit. The majority of pre- and post-observation PBL interviews were performed in the case study teachers’ classrooms; some were performed in my classroom. In the later interviews, I focused on teachers’ efficacy beliefs toward implementing new teaching methods, their reflections on PBL unit experiences, and how they planned to continue PBL implementation. Appendix E contains the interview protocols for both pre-PBL and post-PBL interviews. Throughout the interviews, however, I listened for markers and clues (Weiss, 1994) that directed my questioning and brought deeper meaning to the conversation. I also actively revisited the interviews and my interpretations of the interviews with the participants. Member checking validated the data collected and clarified the meaning behind what was said (Creswell, 2007, 2008; Merriam, 2009; Yin, 2012).

Observations

Observing the case study teachers while they implemented portions of a PBL unit provided insight into how their practice coincided with their efficacy beliefs. During this study, I observed each teacher twice. The observations occurred in between the sets of
interviews. Each observation lasted between forty and fifty minutes and took place at each teacher’s school. I took notes during the observations, focusing on: the classroom environment, what the case study teachers were saying, the case study teachers’ interactions with their students, my interactions with the students and case study teachers, and the students’ interactions with each other. When necessary, I communicated with each teacher via electronic mail in order to clarify occurrences within the observation. I probed into their thoughts and experiences during the final interviews.

Focus groups

Case study participant focus group. After observations, artifact collection, and interviews were completed, I organized a focus group consisting of the four case study teachers. The one-hour focus group meeting took place in my classroom. Sharing the data that I found and eliciting their opinions on the experience sparked a conversation on PBL, their experiences, and teacher efficacy. The data and shared experiences were also used to inspire some participants to describe incidences that did not come out in an interview or observation. Information from the focus group validated some of my previous findings. Member checking and triangulation brought a clearer understanding of the data.

Non-case study participant focus group. I also took my findings to a focus group of four district middle school science teachers who were not involved in the case studies. The half-hour focus group meeting occurred in a district high school conference room. I also continued the conversation with focus group members in other informal settings—i.e. district professional development sessions. The focus group members were male,
ranged in teaching experience from eight to twenty-five years, and had attempted portions of a PBL learning project. During the focus group, I took notes on their assessment of the cross-case themes and their experiences with PBL. The conversation focused on the case study teachers’ reactions to, and the non-case study focus group’s experiences with, student collaboration and effort.

Table 3.2

Data collection timeline for participant groups

<table>
<thead>
<tr>
<th>Case study teachers (n=4)</th>
<th>Focus group, not in the case study (n=4)</th>
<th>District middle school science teachers, not in the case study or focus group (n=11)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete STEBI</td>
<td></td>
<td></td>
<td>March 2013</td>
</tr>
<tr>
<td>Three twenty-minute interviews</td>
<td></td>
<td></td>
<td>April 2013</td>
</tr>
<tr>
<td>Two observations during the PBL unit</td>
<td></td>
<td></td>
<td>May 2013</td>
</tr>
<tr>
<td>Two thirty-minute interviews after PBL unit is complete</td>
<td></td>
<td></td>
<td>June 2013</td>
</tr>
<tr>
<td>Complete STEBI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participate in a focus group with all case study teachers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete STEBI</td>
<td>Complete STEBI</td>
<td></td>
<td>November 2013</td>
</tr>
<tr>
<td>Participate in a focus group in order to analyze case study findings</td>
<td>Complete STEBI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Data Analysis**

Prescribed processes of analysis are absent from case study methodology. The type of analysis used depends on the case or cases, research questions, and available data (Yin, 2012). The data collected in my research were analyzed using pattern-matching and explanation-building techniques (Yin, 2012) and cross-case analysis (Creswell, 2008; Merriam, 2009; Yin, 2012). In Chapter II, I wrote about efficacy and the ability to learn new concepts or teaching techniques. The research questions that I addressed were exploratory, seeking to describe experience and a possible connection between PBL and teacher efficacy. I assumed there was a connection between implementing a new teaching method of any kind and efficacy. Pattern-matching—a method of comparing collected data to previous studies—made sense, because of my literature-based assumptions (Yin, 2012). I compared this study’s data with the available literature on efficacy and new learning. There were, however, no direct resources on PBL implementation in middle school science and its connection to efficacy. Explanation-building is a data analysis technique used to answer open-ended research questions (Yin, 2012). I used explanation-building in order to determine how PBL implementation and efficacy are connected. Although I made assumptions in my research questions, they were open-ended and I needed to understand the deeper reasons behind my findings. Cross-case analysis uncovers patterns and increases naturalistic generalizability in multiple case studies (Yin, 2012). During and after considering the results of each individual case, I sought connections between cases.

Finding themes within and between cases required data coding, a combination of inductive and comparative reasoning (Merriam, 2009), and using my background
knowledge to recognize patterns in the data (Weiss, 1994). In the first stage of both observation and interview data analysis, I bracketed my ideas about PBL and teacher efficacy. I kept an open mind throughout the study and was especially mindful to set aside my beliefs during initial, open coding (Merriam, 2009). Incident to incident and in vivo coding made sense, because I wanted to recognize specific teacher behaviors and thoughts in relation to efficacy and PBL implementation (Charmaz, 2006). After observations, interviews, and the initial coding, I developed my ideas in reflective memos and personal notes. Analytical or axial coding was the second stage of my data analysis, in which I started to develop categories within the data (Merriam, 2009); beginning the analysis and interpretation cycle (Hesse-Biber & Leavy, 2011). Developing code categories, then looking back at the data to see if the categories held true or if I needed to add, take away, or adjust categories, was a continuous process throughout my research. The categories turned into themes as I found consistencies among them (Morse & Richards, 2002; Saldana, 2009).

**Trustworthiness in Data Collection and Analysis**

My data collection and analysis were strengthened with multiple forms of data, member checking, and negative case analysis. I was able to compare the sets of data from different collection methods in order to determine the underlying themes present in these data. Interviews, observations, the STEBI, focus groups, and artifacts were used to triangulate my findings. Triangulation is a technique used in qualitative research that increases the validity, or trustworthiness, of the data (Creswell, 2008; Hesse-Biber & Leavy, 2011; Merriam, 2009). Finding evidence from three or more sources that point to
the same conclusion adds weight to this study’s findings, as compared with a single source. In addition to multiple sources of data, I used a pre- and post-STEBI in order to analyze further the affect PBL has on teacher efficacy. Teachers within the case study were also compared to teachers outside of the case study through the STEBI.

Member checking and peer review in this study promoted the trustworthiness and reliability of my data (Cresswell, 2008; Merriam, 2009). During and after interviews and observations, I discussed my preliminary analyses with teachers in the case study. The case study teachers clarified or restated information that they provided and had time to reflect on their experiences. I also described the cross-case themes to the case study participants, confirming their existence within the data. As mentioned previously in this chapter, member checking helped prevent preconceived or inaccurate conclusions. The focus group of teachers outside of the case study also provided guidance in analyzing data and the themes that I created based on the data. This, along with my dissertation committee, was a form of peer review in which colleagues determined the appropriateness of my analysis.

Negative case analysis involves finding supporting evidence for an alternative conclusion (Hesse-Biber & Leavy, 2011; Merriam, 2009). Searching for negative cases validates data analysis. When researchers find a negative case, they can adjust their original thoughts, make new assumptions based on the negative case, and analyze the reasons that the case failed to fit into one of their categories (Hesse-Biber & Leavy, 2011; Merriam, 2009). As I synthesized the data in this study into categories and themes, I sought evidence that refuted my explanations. There were incidences in which the portions of themes, failed to hold true for all or most teachers in the study. In these
situations, I adjusted the focus of the theme or—when one teacher did not experience the theme—I reported the theme and included why that teacher failed to fit the theme.

Summary

Phenomenological case study is the primary methodology in this study. The four teachers in this study implemented PBL and participated in interviews, observations, and focus groups. Participant confidentiality was addressed. I analyzed the data on a case-by-case basis and looked for patterns within and between cases. In addition to multiple data collection methods, I used member checking, document analysis, and negative case analysis to triangulate the data. The next chapter provides a description of each case and explores within case themes.
CHAPTER IV

TEACHER CASE STUDIES

Introduction to Teacher Cases and the PBL Project

Within Chapter IV, I will present four case studies involving teachers that implemented PBL. Each case starts with an introduction to the participant teacher, in which I describe my view of the teacher and our relationship. Following the introduction, I will describe each teacher’s pre-PBL viewpoints—based on interview data. Post-PBL viewpoints—also based on interview data—are presented after the pre-PBL viewpoints section. I conclude each case study with a reflection on my classroom observations of each teacher during the PBL unit and themes drawn from interview, observation, and artifact data.

I created the PBL, which teachers in this case study were implementing, in order to address earth science standards in sixth grade science. The goal of the PBL was for students to design and, if possible, build a model of a statue that represents the sixth graders in our school. Students chose the rock, out of which they would make their statue, considering weather, cost, rock characteristics, mining, and shipping. They wrote a proposal that explained the characteristics of their rock, defended their rock choice, and included a scale drawing of their statue (see rubric in Appendix A for details). In addition to a rubric, I also provided a project calendar and introduction sheet. Colleagues outside of this case study and I gave the case study teachers lesson plans for the earth science unit. Throughout the project, students were learning earth science concepts (i.e.
the rock cycle and the characteristics of different types of rocks). The teachers presented
the project as a contest between groups of students in participating science classes.
Teachers chose the contest winners based on the quality of their written proposal and the
creativity of their statue.

Case One: Al

Introduction to Al

“I have an app for that” is a staple of Al’s teaching. Al is tech savvy and likes to use
various forms of technology in class to help engage students and present material. He
considers himself a problem solver and wants to learn teaching strategies that help kids
become problem solvers.

Al and I have taught next door to each other for four years. During his first two years,
I served as a mentor for him—providing lesson plans, co-teaching, and problem solving
issues with him. Al and Kelly, one of the other four participants, became science fair
coordinators—taking the position over from me and another teacher. I guided both of
them through the first year of that process. My relationship with Al has become mutually
beneficial within the last couple of years. We share lessons, co-teach, and problem solve
together. There are times when I rely on him for ideas that address content presentation,
student behavior, and lesson set up. Al and I trust each other.
Pre-PBL Viewpoints

Defining PBL

Al’s definition of PBL involves a project that has a curriculum-connected goal, ending with a tangible product. “The general definition of PBL is that you have an overall project goal that the kids have to accomplish. The goals connect to learning targets that the kids have to master in order to accomplish the goal.” The students work in groups to create something tangible, either a report or an object. As they create the final product, they learn the content. Al’s definition of PBL is content and product-focused and accurate in comparison to accepted definitions of PBL (see Chapter I).

The PBL process has value to Al.

I like the idea of project-based learning because it ties in real life experiences. Kids, when they come out of school, they’re going to have to work together to bring all the different academic classes together, to come up with something that is useable in real life. None of the subjects stand alone. It helps kids see the real life use of the things we’re learning in science.

Real life experience and cross-curricular learning created a reason for Al to attempt PBL. Al explained that PBL would help students retain more, because they are seeking the knowledge—rather than a teacher giving them the knowledge through a lecture, textbook, or video. “If they’re doing it on their own, they’re more likely to hold onto that information.” Performing self-directed research will also help his students make connections to previous learning. Al describes that his students will “be able to retain
their current learning more because they’re actually attaching it to other things that they have learned.”

**Confident nervousness**

“Oh my goodness, no way in the world” was Al’s initial reaction to PBL. This was his first time attempting PBL, which made it difficult for him to picture the process and final product. “You can go online, you can find what other people have done, but not having done it or experienced it before, I don’t know what the results are going to be, or whether I want those results.” Al was nervous about the process and the final product, but had confidence in his ability to finish the PBL. “I am nervous on how pretty it will look along the way, but it will get done and they will learn something. I have confidence in that.” Al struggled, however, with his ability to provide enough resources for the students to be successful. “As far as motivating the kids, I’m not too nervous. It’s more about whether I have enough information about rocks, and whether I can pull together different resources for them to find information they need to start problem solving.” Al’s most prominent goal was his students’ getting a quality learning experience from the PBL.

**Post-PBL Viewpoints**

**PBL versus traditional projects**

“The whole idea of project-based learning is: you’re taking several concepts and putting them together. Students have to show how concepts relate in order to accomplish
something.” The idea of connecting learning represents Al’s concept of PBL and distinguished PBL from typical projects. “We do cell city, where they create a project based on the organelles of a cell, but I wouldn’t consider that a PBL. It’s just a project at the end of their learning.” The connections students discover make PBL more complicated than a smaller project. “It’s more complex because, you’re using PBL not only to learn each of the individual ideas, but how those ideas connect with one another.”

Al embraced inquiry learning and wanted to complete more PBL units with his students, including the PBL unit from this study. Despite some “tweaks we need to make,” Al thought that PBL was more beneficial to students than traditional projects. As described in the “Teaching and creating PBL units” section and the within-case themes, Al was interested in continuing his use and development of PBL units. Prior to the PBL, he was unsure whether sixth graders could possess problem-solving and critical thinking skills. The “thought process” that his students experienced during the PBL allowed Al to contemplate their abilities to develop these skills.

**Teaching and creating PBL units**

Al explained that he was confident in teaching a PBL that someone else had created. His understanding of a PBL’s design and agreement with the PBL creator’s teaching philosophy are important to Al in determining whether he attempts it. “If I look at it and I don’t see how it ties together, then it would be really hard to teach.” He is more likely to use a PBL from someone with “similar philosophies or ideas.” If he does not get it, the kids will not get it. “I would have to make sure it made sense to me before I would have complete confidence in it.”
Creating a PBL unit would make Al uncomfortable; he lacked confidence in his creative ability. “I’m not sure if I’m that creative of a mind, or whether someone else would have to have the idea and I could help flesh it out.” Though Al explained that he is not comfortable with creating a PBL unit, within our interviews he described an idea that he had for a cross-curricular PBL unit about rockets. He wanted to work with a math and social studies teacher to develop it.

I had talked with math and social studies teachers about working on a rocketry competition. You build a rocket, talk about the times you use rockets, and work on trajectory. We create a target out on the field, make bottle rockets, and launch them.

**Reflections on Observations**

**Designed for collaboration**

Al’s room was set up for group interaction. Students were facing each other at tables of four; no one was facing the front of the room. During the first observation, students were researching and writing about topics for the PBL proposal. Al met with groups in order to discuss their progress, offering praise, and explaining what was missing from their proposal. Student behavior oscillated from social to project-focused. Al spent the majority of his time meeting with groups or multitasking—simultaneously signing passes, fixing laptops, and assisting students with the learning process.
Excited volunteer readers and their learning needs

The second observation demonstrated Al’s ability to adjust his teaching in order to meet student-learning needs. He recognized that the students were misunderstanding weathering and erosion in the rock cycle and addressed the gap in their knowledge. After an online video clip about weathering and erosion, Al had the students read a portion of the science textbook on the two subjects. As Al asked kids to read in front of the class, hands flew up in the air. The amount of students wanting to read aloud surprised me. Al pointed to certain students, giving them a number that corresponded to a paragraph. At that moment, I saw why the kids were so excited to read. The first student to read stepped up to microphone of a karaoke machine. When she read, it was loud and clear. Students ignored minor reading mistakes and refrained from interrupting or correcting her. Al tried to get her to sing, but she gracefully declined with a smile. As they read about weathering and erosion, most of the students were following along in the book. Another girl read a passage. She read well, at one point looking at Al for a confirmation on a tough series of words. He nodded in approval and said one of the words out loud, “uniformitarianism.” The kids were mostly focused on the book; some looked up at the reader or Al. After she finished reading, Al explained the meaning of “uniformitarianism.” The students were gaining content knowledge and displayed self-confidence. Toward the end of the lesson, I was waiting for Al to connect their learning back to the PBL proposal. The connection was obviously there, but he refrained from asking the students about it.
Within-case Themes

The thought process

In our first interview, Al brought up the idea of the “thought process.” He described the thought process as critical thinking and problem solving. Teaching students how to go about solving a problem helped develop these skills. Al describes the thought process and its importance, saying:

Students isolate the problem, figure out the parameters, and then start learning skills it takes to find solutions to those problems—whether it comes from research, trial and error, or fine-tuning their problem solving skills. When they move on to another class or graduate, they can use these skills. Instead of figuring out a type of rock to use for a statue, they can use the same skills to figure out how much cloth they’re going to need to make a clothing line, or how much mulch they need to landscape a certain area, and which mulch would be the best.

Students have to know where to get information and use the knowledge gained from addressing previous problems to solve current problems. As Al explains, this skill is useful in students’ potential careers. “If you train students how to think and problem solve, they can use techniques that address their problem. They will, therefore, learn how to handle the problems of whatever business or whatever profession they go into.”

Though Al finds value in the thought process, he is uncomfortable with its “messiness.”
This is my first PBL. I’ve done some inquiry learning before, and I like quiet, I like structure. I don’t mind problem solving myself, but it makes me nervous, when I’m having the kids do it. They come up and tell me what they’re learning and some of it is not right. I start worrying, “Am I helping them out?”

Sometimes students go off on the wrong path and learn incorrect information or have misconceptions, which causes Al to doubt his allowing students to independently research. He worries about doing the students a disservice, his ability to get them back on track, and thinks that sixth graders are unable to become great problem solvers.

I like to think I’m doing a good job of making students into problem solvers. I work with sixth graders. I don’t think they’re great problem solvers, or with their developmental state, they’ll be great problem solvers. It’s something that I question myself on. I try to figure out better ways of helping them learn, which puts the onus on them to figure out what they’re doing, to figure out the problem. It causes a lot of frustration.

He went on to describe a situation in which his students had collected inaccurate data, leading to an inaccurate conclusion. When he gave them the correct data, they were able to come to a reasonable conclusion. Situations like this frustrate Al, but he thought that the PBL process helped him develop problem solvers in his classroom. “It’s projects like this that will make it possible for students to come up with problem solving ideas. They are less specific in what the results should be as long as they showed they learned the same knowledge.”
Reality versus creativity conflict

The ideas of trading reality for creativity and creativity for reality permeated Al’s mind. He described that, realistically, statues are going to be made out of only a few different types of rock.

By eliminating the cost factor, they can find more unique stones. I’m not sure if that’s good or bad. We’d get more stones looked at, but you’re never going to build with some of those because they’re rare and you can’t get them.

He discussed having an expert come into the classroom to provide a realistic viewpoint. The first-hand knowledge would be great for Al’s students, but he was afraid it would limit the students’ choices. Al expressed his concern, saying, “Talking about specific rocks would be interesting and good for students to hear, but then we would hear the exact same stuff in their papers.” He thought that the proposals should look different from one group to the next and that having too much information would have limited kids to realistic choices. Later in the interview, he realized that limiting may not be a horrible thing, because even the rocks typically used for statues are new to most kids. “I go back and forth, but it’s the first time they’re doing the PBL, the only time they’re doing it. If they use granite, limestone, or marble, then that’s new to them.” Al thought that either idea would work; he would just have to decide which way to go before hand. He would have to either be realistic, limiting the students’ choices to typically used rocks, or open to creativity, allowing students to choose rocks despite their rarity or cost. In the end, it seemed that he was leaning more toward realism, saying:

It makes sense to have an expert, have the kids prepare questions about different types of stones, and tell him in advance, “They might ask you about this stone.
It’s okay to say, ‘I’ve never heard of that, because it’s either extremely expensive or you just can’t get it.’”

**Humor, rapport, and classroom management**

I noticed in the observations that Al used humor in the classroom. When I asked him about it, Al explained that he uses humor to build relationships and manage the classroom. “That’s part of the relationship building, making kids feel comfortable in the classroom and with one another. I correct off task behavior in a way that does not make them feel horrible or like they’re being punished.” Al addressed my question about drawing a line between making fun of a student and using humor, saying:

I keep the comments and the jokes to something more general than specific. Sometimes we joke about a specific behavior. Someone does something that’s ungraceful and, rather than being embarrassed, we joke about it, so that the kid sees it’s funny. It’s over, everybody’s laughing, it’s no big deal . . . I try to make the comments or jokes such that they’re not personal and I don’t dwell on one kid over and over again. I try to use the humor in what we’re doing as compared to exactly what the child is doing.

After discussing how he uses humor, Al said that humor does not help him manage the classroom, but does help build relationships.

The humor part builds the personal relationship with the kid, so that they’ll do more of what’s asked of them. It’s probably counterproductive to classroom management because they start laughing, they get excited, and they want to keep
going with the jokes. I try to keep a balance between having fun, engaging them, getting the personal relationship, and getting work done.

Case Two: Peggy

Introduction to Peggy

Peggy is someone to whom her colleagues go for advice on student learning and behavior. People within our school district, with whom I have spoken, said that she was a leader within her school’s science department. She and I have known each other for about three years. Meeting at various science department professional development sessions, we soon recognized the similarities in our teaching style and philosophy. We both encourage students to think critically and provide them the hands-on experiences necessary for inquiry-based learning. As I watched Peggy teach during this study, I felt as if I were looking in a mirror.

Pre-PBL Viewpoints

Defining PBL

Peggy explained PBL as “seeing the big picture before we start.” The application piece struck a chord with Peggy, because she was not the type of person to enjoy lectures and note taking. She described PBL to a colleague, saying “It’s learning as you work, learning as you do. Diving in and getting your hands dirty. Literally.”
Experience with inquiry

“I found that in a project challenge book,” Peggy said proudly as she explain the slow coaster project her students were working on. The inquiry learning process was nothing new to Peggy or her students and she thought that she prepared her students for the upcoming PBL unit. During the slow coaster project, students were using their group-built rollercoasters to discover energy concepts. “They figured it out yesterday, on their own, with kinetic and potential energy. I didn’t have to do a whole lot because we did it through building the slow coasters.” When I asked how often her students participated in activities like this, Peggy explained that all of her students complete a design challenge once per month and her advanced students complete two per month. Peggy had three types of classes: advanced, regular, and inclusion. Advanced classes have students who are considered gifted, regular classes are heterogeneous, and inclusion classes include students with special needs. At the time of this study, she had one advanced class, three regular classes, and one inclusion class.

Benefits of PBL: Retention and collaboration

Peggy believed that PBL would help with her students’ learning needs and retention of information, meeting their desire for hands on learning. “I think they’ll be great, because they love the interaction. Of course, they don’t want to sit and open a book all day, every day.” She liked to get the kids hands-on as much as possible, as mentioned above in her explanation of the slow coaster project and monthly design challenges. Experiences, Peggy described, help her students retain knowledge.
They won’t forget it. There’s no way. With the PBL—if we have samples here, we are looking at monuments on video clips, and they can get their hands on some rocks and minerals, and they can start thinking about what we can use to build a monument—that knowledge sticks.

Group work was also a benefit of PBL. Students would get a different perspective while working in groups. “Any time they’re working as a group, they get tidbits of information that they may not have gotten on their own and hear other people’s points of view.” Peggy focused on collaboration and social skills prior to the PBL. Interacting with her peers is important to Peggy; therefore, she wanted her students to interact as well. She engages students in post-group work reflections that help them analyze the positives and negatives of their group. “We do a lot of reflection. What will you change for next time? Will you work with the same people? Why or why not? And, then who can you bounce ideas off of?” Most of the time, she chooses groups or the students have a structured choice. “They never work with the same people. We do the partner clock. Sometimes, I let them choose their group. I want to see if it is a popularity contest or will they choose someone who will do work?” Having students exchange contact information is an important step in the collaborative process. Peggy has her students exchange e-mail addresses and cell phone numbers, in case they miss something in class or need help from a peer. “They should be able to (a) use their cell phone to look up some information, or (b) call somebody.”
**PBL preparation**

Peggy had some professional development with PBL. She took one class, during a staff development day session, which was about an hour. It was an introduction to PBL design, which I taught. She also found two books while cleaning out the science storage room at her school. “I just found them yesterday and flipped through very quickly. It looks like they’re going to help me. With your staff development day presentation, the resources that I have here, and other teachers, I think we’ll be fine.” Even though she had basic knowledge of PBL, she said that it was a new concept for her. “It was new to me, even when you talked about it at the staff development day. Anything new makes you a little apprehensive, but I’m excited.”

**Content comprehension means PBL success**

An accomplishment would be noticeable, if we reflect on our content statements, and ask, “Did we understand these?” If the students are able to give me some information back, such as in a reflection journal—that’s an A-plus for me. If they walk away with the knowledge, then I’m all right. Some of it at least, because we know that they’re not going to get everything the first time.

Peggy explained that student content acquisition was her guidepost for success. If the students were getting the content knowledge, then the PBL would be a success. Success also meant that she would learn from the experience and know what to change for next year.
Overcoming initial pressure

Peggy thought that she put too much pressure on herself at the beginning of the PBL. It was new to her and she was worried about whether she would be successful. My dissertation research relying on her implementing PBL made her worry more, because she actually wanted it to go well for me. Even though I told her that it did not matter what she did or said and my research was not about an ideal PBL unit, she still pressured herself to do well.

After the PBL, she admitted that it was easier than she expected. Peggy felt like she had done PBL before, because it was just an alternate arrangement of the inquiry learning she was already doing in her classes. The PBL was “a different way of presenting information.” Her post-PBL STEBI showed little change in her responses. Peggy also reported little change in her STEBI responses and efficacy during the post-PBL interviews.

The textbook as one of many resources

Using resources besides the textbook was something of which Peggy was proud. The students saw the textbook as one of many resources, instead of the source of all knowledge. “They had to dig a little deeper than the textbook or the person next to them. . . I didn’t use the textbook a whole lot for classroom activities. They used it more as a research tool.” Peggy thought she did a good job at supplementing the PBL with labs and activities, enriching students’ abilities to create a high quality final product.
Increased effort in special education students

A triumph for Peggy was her special education students’ increases in effort. She explained that they worked harder than they had ever worked before. They were learning from their peers and keeping up with group responsibilities. A mom, concerned about how working with a special education student would affect her child’s grade, emailed Peggy to express her concern. Peggy talked to the special education teacher and responded to the mom’s email, saying that the special education student did more work than she had ever done before.

I responded back, saying, “His partner, the other student, was doing a whole lot of work, compared to what he usually did in class.” For this special education student to type a title and a paragraph, and then draw the statue on top of that, it was time for my jaw to hit the floor.

Peggy also experienced true team teaching, while working with the special education teacher assigned to her room. “Our special education teacher and I were able to tag team the entire class. He wasn’t stuck with his kids, because they were everywhere. We were able to interact with everyone on a different level than we normally did.”

Reflections on Observations

The power of rapport and a positive environment

In my observations of Peggy, I noticed that she had amazing rapport with her students. An example from each observation displays Peggy’s relationship with her students. In the first observation, she helped a hesitant group and offered positive reinforcement
throughout the discussion. “You are rocking” and “look at you smile” were phrases that Peggy used to motivate her students. The second example demonstrated Peggy’s ability to recognize students’ skills outside of the science content. As students were finishing a worksheet activity, Peggy and I were talking about music. She took time out of her class to ask two girls to sing a new pop song that I liked. The girls sang beautifully and the class erupted in applause afterward. I left the room understanding the comfort level and trust between Peggy and her students. Other outcomes of Peggy’s encouraging rapport were debates, discussions, and questions that I heard between group members. The students thrived in a relaxed, yet focused environment.

When I asked her how rapport affected the PBL, she explained that it helped her try new things with her students. “If I was someone they did not get along with and I said, ‘Okay, we’re going to try this,’ they could put up a resistance. It’s all about how you present it.” Her rapport with students made them more accepting of new ways to learn. It also helped them buy in to the competition part of the project, which was a motivator for many of her students. They wanted to out-do their classmates and put forth effort to win. “I think the more excited I was, the more excited they became. If I kept up my enthusiasm, it showed in their work.” The environment that she created made them feel confident in their abilities and comfortable enough to buy in to a different learning method.
Within-Case Themes

**Learning with her students**

Peggy explained that learning along with her students made her a better teacher. Every year, she tells her students that she does not know everything and they are in a learning phase together. “I’m all right with learning along with them, because I think it makes me human.” According to Peggy, teaching something the same way repeatedly makes teachers complacent. Learning along with students keeps her out of the routine of teaching. There is an excitement behind learning with the students and it makes her more willing to try new things. “New things pop up and I say, ‘Hey, let’s try it! Let’s see if it works,’ because I don’t know if it works. It’s something I have never done before. I’m a better teacher when I learn with them.” She noted, however, the disadvantages to learning along with students, mentioning the ambiguous nature of the process. If it does not work, you have to be able to adjust plans. The outcome of the learning process, Peggy explained, is also unknown when learning along with the students.

**Homework for points**

Peggy said that she stopped grading homework when she noticed rampant cheating on homework assignments. She opened up about her first year of teaching, when I asked her why she graded homework at that time:

> When I first started, I listened to seasoned teachers, and they would say, “You need to make sure you have about three hundred points by the end of the quarter or semester.” I’m saying to myself, “If I have a twenty point quiz, I need some
stuff in between there to get to three hundred.” I was listening to what they said.

When I graded homework, that was my reason, for points.

After attending professional development about differentiation, she found out that she did not have to grade everything. She could give check-up quizzes and assess students in order to guide their learning. This is a process called assessment for learning. There are formative assessments, which are diagnostic, letting the teacher and student know the status of the student’s learning. Formative assessments eventually lead to a summative assessment, which is an evaluation of the student’s learning. As Peggy started to practice assessment for learning, she used homework as a step in the learning process, rather than a grade.

**Prayer and tears: A source of Peggy’s confidence**

Many of the factors above gave Peggy confidence in her ability to perform the PBL. When I asked her from where her confidence came, she added a story about her previous teaching experience. She was a first and second grade teacher at a charter school with little resources. “It was the bare minimum” at her school. She did everything that she could to keep her “head above water.” It was a struggle, but she experienced some successes. When the fourth graders began taking proficiency tests, they were failing miserably. The leaders at the charter school decided to put Peggy in a fourth grade classroom, because of her positive influence on her first and second grade students. After a year, the students were passing the proficiency tests. This success gave her confidence in her abilities and allowed her to make a change in her career. She wanted out of the charter school system and into public education. When she came to our school district,
she was able to utilize resources—that had previously been unavailable at the charter school. She described her charter school years as if they were a trial by fire. When I asked her how she got through it she said, “A lot of prayer and tears.”

**Case Three: Marcy**

**Introduction to Marcy**

Marcy is a skeptical worrier who is willing to take risks. When I am in meetings with her, she is typically the person that thinks of multiple things that could go wrong with our plan. Despite her nervousness, she is willing to try new approaches to teaching. I have found her opinion valuable in science department meetings, because it is grounding. People come up with “pie-in-the-sky” ideas and she brings them back to reality. This aspect of her personality is abrasive at times. I have seen her debate aggressively with colleagues, including myself, on student learning issues. As I have gotten to know her over the last four years, I have come to understand that her combativeness is her way of getting to whether or not ideas work in the classroom.

**Pre-PBL Viewpoints**

**Defining PBL**

“It’s exciting; it seems like a good idea in theory. I’m nervous to see if it will translate into the classroom.” Marcy believed that classrooms are becoming student-centered and inquiry-based, and that PBL will be the new way learning is accomplished. Science, to
her, is the best vehicle for this transition. The theory behind PBL, according to Marcy, is that teachers are “making sure that the application process is there.” The application process, for Marcy, included students’ using skills and knowledge in order to complete the project.

**The haunted house of change**

Marcy said that change is like a haunted house to her. All of the anticipation troubles her, but the anticipation is worse than the haunted house. “I don’t want to go, I don’t want to do it, but then I feel like this is what I have to do. Once you get there, it’s fine. Once you’re in it, you can see it.” The “haunted house” feel in this situation may have come from Marcy feeling like she is “on an island” while performing this PBL. No one else in her building is attempting the PBL. There are twelve new teachers in her building and half of the science department is new. “They’re doing whatever their mentor or their colleague is doing, just following along to stay alive.” She believes that the teachers who are not attempting PBL are “set in their ways of teaching and are afraid to branch out.”

Having a face-to-face conversation with colleagues was an important part of Marcy’s reflection process. Without having someone in her building with which to share ideas and concerns, she foresaw difficulty with the PBL. Marcy felt like a guinea pig; other teachers were waiting to see what happened in her class, before they try PBL.

**PBL: What’s the point?**

The PBL and the new content made Marcy uncomfortable. Teaching rocks was new to Marcy and she was struggling with keeping up with the subject matter. Having a
teacher at her school who understood the content helped with the transition to the new material. Though Marcy said that she was more comfortable with the PBL than the content, she talked at length about her lack of understanding of the point of the PBL and the lack of resources for her to teach the PBL.

We start to think about linkage and all that accountability stuff that are coming up. People are looking for certain things and, sometimes, people have hidden agendas, and I don’t necessarily mean as teachers or our curriculum coordinator. There are higher-ups that don’t always tell you what they’re looking for. They expect you to know how this PBL is going to work and that it’s going to work. Since there was such a big push to do PBLs, that’s what was required, and that’s what was going to be done. Well, “What do you want the kids to get out of it? How are we trying to structure this for the kids? Don’t just tell me I have to do a PBL—what’s the point?”

Linkage, which Marcy spoke about, connects teachers to student growth and achievement on standardized tests.

Though Marcy said that she failed to see the point, she explained that she thought PBL was a new way to approach learning and meant to help students apply learning, rather than “spit out” knowledge on a test. Her ideas on the point of PBL were accurate, but she was struggling with whether she was right. She felt as though there were multiple expectations for the PBL, but the district’s expectations were not explicitly stated and there were not enough resources to meet the expectations for PBL. “Kids are doing so much at home, then they come to school and we tell them to put all their technology away and we’re going use this book” She also thought that she was inadequately trained for
PBL implementation, because of a lack of district support. “We were not supplied with everything that we could have been. The board says, ‘We want PBL to occur. We want this to be happening in our schools.’ Well, I say, ‘What are you doing to help us accomplish those goals?’”

**Engagement and application equal PBL success**

When I asked Marcy how she would measure success for the PBL, the most prevalent benchmarks that she mentioned were student engagement and application of knowledge. Student engagement would mean that her students were gaining content knowledge, which Marcy determined was only part of the goal of PBL. “I want to make sure that they have that opportunity to move on . . . that they’re able to move at their own pace, so they’re always engaged with whatever it is that they’re doing.” Content mastery is only part of PBL success. “It depends on how you define success. Mastering content is part of it. Is that the overall goal of the PBL? I would say no . . . the overall goal is applying the knowledge to everyday—real world application.

**Post-PBL Viewpoints**

**Application: Changing the way students think**

“It pushes them to grow up and change the way that they’ve been thinking, but I don’t think that they gained more knowledge about rocks from the PBL.” Marcy believes that the PBL was more effective in its ability to have students apply, rather than accumulate knowledge. Teachers at another district middle school—who were not completing the
were teaching their students more detailed vocabulary than Marcy was teaching her students. “I feel like some of the kids lost the rock part.” Though she believed that the PBL failed to enhance knowledge any more than a normal unit of study did, she explained that it did prepare them for future science classes (e.g., they acquired a taste for more advanced thought processes).

**Stepping back and student freedom**

As Marcy explained in the pre-PBL interviews, her classroom was more teacher-centric. During the PBL, the students were at varying points in their learning and she had a hard time with the amount of student freedom involved in the PBL.

> Everybody was in a different spot and that was hard for me. I didn’t feel like, management-wise, at any given point, I knew exactly what each person was doing. That’s part of the PBL; that’s part of me giving up a little bit of control.

Some of her students took advantage of the freedom and generated quality projects, while others struggled to maintain adequate progress. In one instance, she described helping a student with solving a problem, then finding out that he was working on the same problem two days later. Though she was apprehensive and, at times, frustrated about giving up control, she enjoyed the results of “stepping back.”

> It was good to see that I could step back in some classes, and they could continue to ask questions. One of my classes had trouble getting started, and I made it a little bit more structured. I was able to back off more towards the end.
Marcy’s best effort

Marcy felt that she put in the same effort during the PBL as she always did. She took exception to the use of the term effort on the STEBI, explaining that she always puts forth her best effort. “I always put forth effort; maybe I changed the way I presented it. I don’t know if I think that was effort. I think that the PBL was something that I did differently.” Marcy does not see her implementation of PBL as an “extra effort;” she just presented the information in a different way. “I think that’s a part of your job. That’s what you’re supposed to do. I don’t necessarily think that trying something new is extra effort or above and beyond what they’re asking you to do.”

Reflections on Observations

Teacher-directed vs. student-directed

As I watched Marcy teach, I saw her swing from strictly teacher-directed to a mix of teacher and student-directed learning. During one observation, she led students through a note taking activity in which she outlined everything they were supposed to do and exactly when they were supposed to do it. Students had no voice or choice; they sat in rows, facing forward, copying notes. There was student interaction during the lesson, when she involved students in a rock cycle game—during which students walked around the room reading information about the rock cycle and rolling dice to see where they would go next.

My second observation showed Marcy swing toward a balance between teacher and student-centered learning. Students were working independently on their projects. As
Marcy met with each group, she would determine whether they were making adequate progress. If they were not making adequate progress, she would make goals for them and assign students specific questions—she had changed the original rubric into a set of questions (see Chapter V for details on the rubric change). Groups that were performing well had freedom to make decisions on their own. She excelled at leading students through content learning and task completion in a collaborative, student-centered manner. Goal setting and accountability was teacher-directed in cases where students were lacking their own direction.

Within-Case Themes

Student experience with inquiry and critical thinking

Prior to the PBL, students in her advanced class had experience with inquiry learning during monthly design challenges and were competent problem solvers. She thought the students in her intervention class, however, would struggle. “It will be a stretch for them because I think that a lot of them are used to, ‘Here are the five questions that you need to figure out. You need to make sure you’re following the directions.’” Some of them, she said, will just sit there, while others will beg her to tell them the answers. She wondered what these students would do when there is no procedure to follow.

After the PBL, Marcy did not notice a major difference between her intervention group and other classes. She expected more from all of her classes. “The products weren’t exactly what I had anticipated.” As mentioned in the “Stepping back and student freedom” section above, some of her students performed well when given the freedom to
make choices, while others produced little. Marcy did notice, however, a difference between her advanced class and the rest of her students. She explained the difference within their proposals:

Some of them wrote in their paper, in my enriched group only, “After researching this, we don’t feel like this is the best rock that we could have picked.” I was okay with that, because they realized that along the way. Groups in my other classes would list disadvantages that clearly made the rock that they chose not a good idea, but their conclusion was still, “This is the rock we should pick. This is the best idea.”

**Balancing the amount of structure**

Balancing structure and looseness in her teaching was a goal to which Marcy strived, because this school year had been more teacher-centered than prior school years. “The other seven years that I’ve taught, it’s always been much more student-centered than this year.” Because her class has been more teacher-centered, she was afraid that her students would not respond to a completely unstructured class during the PBL. This prompted Marcy to add more structure to the PBL. On the PBL calendar, she mapped out exactly what they were supposed to be doing on each day. If it was a research day, she had a topic that the students were supposed to focus on. This differed from the calendar that I created with general areas of study for each week. When I asked Marcy why she thought balance was important to her teaching, she said, “If I was on the lack of structure end, that doesn’t work for me. On the other end, I would have so much backlash from the kids
that being a control freak wouldn’t work either.” As I described in the observation data above, there were times of balance for Marcy and times of teacher-directed learning.

**Comparing herself to others: Honesty is difficult**

The dread of people comparing Marcy to other teachers permeated her mind. “This is all just me—my perfectionist personality. I don’t want to disappoint people. I want to make sure it is done right. I want to make sure that the kids are getting everything that they’re supposed to be getting.” Feeling inadequate or less than someone else was a disturbing thought. When I asked her about filling out the STEBI, she said, “I doubt myself a lot, but I try and keep those doubts to myself so that they don’t come out. Being honest is difficult.” She thought that she could always be a better teacher, saying, “There are some things on the STEBI that, some days, I strongly agree with. There are other days where I don’t agree—I could have done things better.”

**Case Four: Kelly**

**Introduction to Kelly**

Kelly is a self-professed perfectionist. Teaching next door to her for the last five years, I have seen her perfectionist side—her bulletin boards put mine to shame. Her growth as a teacher, however, outshines her perfectionism. As with Al, Kelly and my relationship has evolved into a collaborative partnership. I served as her and Al’s mentor as they took over science fair. For her first couple of years, we each taught a separate advanced science class. I helped Kelly work through logistic, political, and learning
issues that arose in and out of the classroom. She has since taken over all advanced
classes for sixth grade science. At this point in her career, she is someone whom I, and
many others, trust to ask for advice on student learning and behavior.

Pre-PBL Viewpoints

Defining PBL: Engagement and content mastery

Kelly views PBL as a more engaging way to approach learning than traditional
methods of teaching. She liked the goal achieving aspect of PBL and wanted to “see if
it’s something that works with me and my kids, and if I’ll be able to continue to do it.”
During a PBL unit, she described, students would use technology, work collaboratively,
and create a product that displayed their mastery. “It’s a way for the students to learn
about rocks in their own way, in their own terms, and then to create something that
represents what they have learned throughout the whole process.” She explained that the
goal of PBL was to start with a large concept, break it into smaller chunks, and have the
students create an output. The chance to collaborate, engage in hands-on, minds-on
activities, and be creative would motivate her students.

In Kelly’s world, content was king. When I asked whether the learning process or
content was more important, she said, “It’s more about the content. The process is
important in this PBL, more than what I’ve done so far this year. Content is number one,
but process is important.”
More support than professional development

Kelly was unsure about her preparedness for the PBL. She explained that she had little professional development for the process and a professor mentioned PBL once in a college course. Despite the lack of professional development, Kelly felt supported because of her colleagues. She knew that she could talk to the people at her school or in this study in order to gain insight on the process. “I know it will be a learning process . . . I’m not going to fall flat on my face, because there are people there helping and supporting, and we’re learning together.” Another teacher in the study, Al, was a day or two ahead of Kelly in the process and following another teacher through the PBL was comforting to Kelly. She could discuss potential issues with him, find out how his students reacted to the current lesson, and ask him about upcoming lessons. “That always makes me feel a little bit better, when I’m not the first one.”

Understanding content

Content knowledge was also a concern for Kelly. Her overall confidence would increase, she said, with more science content knowledge. She would be more prepared to field technical science questions. The new curriculum was weighing more on Kelly’s mind than the PBL. “I should be more of an expert than the kids. Some of my advanced kids are into rocks, and I’m learning from them. That’s fine, but I still want to feel like I have a lot to give them.”
Planning for resources

Resources were an area that required planning for Kelly. She scheduled time in the computer lab or with laptops first, then built the rest of the project calendar around those dates. There were many outside time stealers that worried Kelly (i.e. standardized testing and non-academic school functions). She explained that there was plenty of time for her to get through the content of the PBL, especially with her advanced students—they already understood some of the concepts. The availability of technology worried her more than time. “I’m thinking they are going to need more time to research and then I’m not going to have technology available for them.”

Post-PBL Viewpoints

Success and support breed confidence

Kelly described the PBL process as “natural and easy.” She felt relaxed, because her colleagues were there to support her and she knew that the students had a responsibility to learn. The facilitator role was comforting to Kelly. Stepping back and letting the kids figure things out allowed her to assess where students needed her most. She thought that she provided quality content lessons for the students and, if something went wrong, she had two other teachers in the building with which to have a conversation.

“I felt good about the whole process. I feel confident in what I did, and in how the students performed.” Kelly enjoyed the PBL and was willing to complete another one next school year. Echoing her pre-PBL interviews, she explained that the kids learned the content in a new way and PBL was better for them than traditional projects. “I like
PBL better than the typical way, which is teaching, then finding a project... If I taught them everything—characteristics, rock cycle, all that stuff—and then gave them a project, they might have been overwhelmed.”

The success of the students’ projects made her more confident in her ability to teach PBL. Kelly explained that the students’ projects, especially in her “regular” classes, where of high quality, because the product demonstrated that the students learned the content. They met, or exceeded, the requirements of the rubric. “After you do something once and it’s somewhat successful, then you gain that confidence, and I feel that with the PBL.”

**Organizing creativity**

When I asked Kelly about her ability to create a PBL unit, she explained that she lacked confidence in her creativity. She described herself as an organizer, rather than a creative mind. Her parents had little creative skill and she lacked creative experiences when she was growing up. Her confidence lay, however, in her ability to co-create a PBL unit—organizing another person’s creative idea into a unit of study. “I need someone to give me a little bit of their creative juices. If they give me a little start, then I’m usually good.”

**A lack of flow between content and the PBL**

With the large amount of content, some of Kelly’s students failed to see the connection between the content and the PBL.
I felt confident teaching the content. When you interviewed me the first time, I felt overwhelmed by rocks and minerals. They’re not that hard to teach, but there’s so much to know. Some of the students struggled with that . . . I also went back and forth between content and the project. Maybe that was how I set it up, but time was limited and I felt it was choppy—it didn’t flow as well as I wanted it to.

Kelly thought that she separated the PBL into content learning and research, at times, instead of making all of the learning connected back to the final product. On most days, Kelly told the students that the content connected back to the PBL. She admitted, however, that “there were a few days, when we would be busy doing something and I wouldn’t even mention the PBL.” She thought that, if she meshed the content and PBL more often, the students would have understood the flow of the project.

**Evolving through taking risks**

“I’m always looking for new ways to be a better teacher and to reach my kids. I don’t think that will ever stop in my teaching career. If it does, then maybe I should get out.” Constantly evolving was a trait that helped Kelly experience success in the PBL. She explained that it was why she took risks, even when she was nervous about those risks. Her nervousness lay in worrying about whether a new approach or lesson was beneficial to her students. “I get a little nervous that it won’t be good, and I’ll waste a week or two on something that wasn’t helpful to my kids. Usually when I get in it, it’s okay and I work through the problems.”
Reflections on Observations

Tale of two classes

I observed Kelly during two different classes that were each on their last day of project work—one advanced and one heterogeneous class. There was a different dynamic in each class. The advanced class started with students looking at an accomplishment from a previous project, in which they had visited an elementary school to showcase their work. After students had started working on their projects, Kelly took advantage of a student problem-solving opportunity. One of the students brought in some basalt from home. She led the students through the process of using the mass of his basalt rocks to determine the amount and cost of basalt that the group needed.

Some of the questions that Kelly and I received from these students were “knit-picky.” Unnecessary details stood out to some groups (i.e. whether the rock gneiss was fine or medium grained). Despite the distraction of these details, the groups appeared to be on task for the majority of the class period.

My observation of the heterogeneous class started with Kelly asking me to sit next to a struggling group. In the advanced class, Kelly and I stepped in to offer advice on content-focused questions. In this class, however, we worked mostly on group dynamics. She had some of the groups assign members homework and check on each other in order to ensure that they completed their tasks. Two boys in the group, by which Kelly asked me to sit, were having trouble staying on task. When they contributed to the group, however, they added value to the group’s final product. Kelly and I spent most of our time keeping this group functioning. Although the majority of the class stayed on task
most of the period, the two boys needed someone who consistently reminded them of their purpose within the group. When they started to take ownership of their proposal, they became self-reliant. Despite group dynamic difficulties, Kelly explained in her post-PBL interviews that the heterogeneous classes “stepped up to the plate” and created better products than some of her advanced student groups did.

**Within-case Themes**

**She does not know: No big deal or not as smart**

Kelly had a difference in the way she felt about teaching advanced, regular, or struggling kids. The advanced kids, she felt, would be more excited about the PBL concept. They had completed larger projects and were versed in the inquiry-learning process. She was less confident, however, in her ability to teach advanced students than her ability to teach regular students. The advanced students’ amount and level of questions was intimidating and they were less accepting of Kelly not knowing the answer. “When you don’t know, then the advanced students act like you’re not as smart as them. In my regular classes, they’re like, ‘Oh, she doesn’t know—no big deal.’” She thought that she handled this well, encouraging the kids to research with her and explaining that all people, even teachers, should be learners. When asked a difficult question, one of her responses to the students was, “I don’t know that. I’m learning with you guys. That’s a great quality to have—to be an active learner.”

Kelly described her experience with advanced students during her college courses and student teaching as minimal. “The experiences I did in college were more with the lower
end of the spectrum for the students. We were always working with kids who had certain
issues. In my undergraduate program, we did not talk a lot about teaching gifted
students.” Kelly cited this as the reason that she felt more comfortable with typical
students than advanced students.

**Getting them where she wants them to be**

Students who struggle with learning brought mixed thoughts for Kelly. She expressed
apprehension in teaching her typical or struggling students through PBL, because she
thought that they might get overwhelmed and fail to understand where to start. While she
was filling out the STEBI, she pondered the statement, “Even teachers with good science
teaching abilities cannot help some kids learn in science.” She circled “undecided” on
that statement, because she thought that there were external factors that weighed in to a
child’s ability to learn.

It takes a great teacher to help students who come to us with little science content
knowledge or who have struggled, but I think there are other factors that play into
it. A good teacher usually helps students learn, but sometimes, no matter what we
do, we always have . . . I have some kids that I just can’t get to where I want them
to be.

Despite her uncertainty about a teacher’s ability to affect some students’ learning,
Kelly had a process of helping students who struggle with science content. She explained
that she pre-assesses them, in order to get an idea of their current level of science
knowledge. Understanding which science topics the student enjoyed was also important
to Kelly. She wanted to know how to excite the students in their learning. “Working in
smaller groups with those kids is important, because a lot of them need that one-on-one
time, or need a reassurance. They are not feeling confident in their abilities in science.”
As I observed Kelly’s classes, it was evident that she offered students the one-on-one
opportunities which she described.

The recovering perfectionist

Kelly described herself as a perfectionist, which she claimed was detrimental to her
teaching. She explained that she needed to be flexible and unafraid of veering away from
a “perfect” lesson plan in order to address student needs or curiosities.

When things don’t go smoothly, it makes me irritable or anxious. It’s a
characteristic that I need to work on, because flexibility is huge as a teacher. I’m
trying to be more flexible and open to new ideas, but I’ve always been a
perfectionist growing up and with my own schoolwork.

As her career has progressed, she described herself as getting better at “letting things go.”
“Even though I have a good plan for a class period, it doesn’t go as planned. I just have
to be open to a student having a question, we veer off the path, and that’s okay.” Being a
parent has also reduced the perfectionist side of her personality, because she does not
have the time to over analyze everything.

Changing her role

Kelly explained that she used to be a “giver-outer” of information and she got tired of
functioning as the person in charge of learning. At the time of the study, she approached
her class as a shared learning experience—guiding her students on their “journey to
learn.” Collaborative groups and technology usage were the norm in her classroom, which coincided with the principals of PBL. Kelly told me that she decided to change her teaching style because she and the kids were bored and the kids responded positively to independent learning. She reflected on her experiences as a student and their effect on her teaching:

I remember having teachers that seemed like they had done the same thing every year for the last thirty years, you don’t want to be there, and you don’t want to learn it, because it just seems boring. When the teacher is excited about learning, the kids will be excited and want to learn.

Summary

I began this chapter with a brief description of the PBL project process and goals, which teachers implemented in this study. Within this chapter, I presented four case studies involving teachers who implemented PBL in their sixth grade classes. The teachers’ thoughts on PBL, both prior to and after the project, were discussed and within-case themes were presented. I also included, in each case, a summary of classroom observations. In Chapter V, I will present my data analysis and the cross case themes within the data.
CHAPTER V

CROSS-CASE THEMES AND PARTICIPANT COMPARISONS

Introduction

In Chapter V, I will present cross-case themes, my experiences in connection to those themes, and a comparison of participant and non-participant STEBI results. I used recurring categories in the data—that I discovered during preliminary and on-going analysis of interviews, observations, and artifacts—in order to make six cross-case themes (See Table 5.1). As described in Chapter III, the analysis within and between cases was cyclical. I used open coding for each interview and my observation notes—marking and writing about anything that may be relevant to my research questions. After the pre-PBL interviews, I used analytical coding to develop categories within the data (Merriam, 2009). I repeated the open and analytical coding processes for my observation notes, post-PBL interviews, and case study focus group. I continually revisited the data in order to confirm and develop categories, using focused coding in order to compare data within the categories and create themes within- and between-case themes (Hesse-Biber & Leavy, 2011).
Table 5.1

**Categories and cross-case themes**

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<tr>
<th>Categories within cases</th>
<th>Cross-case themes</th>
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**Cross-Case Themes**

**Insecurities and Inconsistencies with Skills Outside of the Science Content**

The PBL involved many skill sets outside of the science content (i.e. making a scale drawing, writing a proposal, using technology, and working as a group). There are two major topics within this theme: collaboration and language arts skills. Teaching collaboration made all of the case study teachers insecure at some point during the PBL. They reported struggling with their ability to teach communication skills and had trouble
with group dynamics. Each teacher expressed confidence, however, in their ability to
teach collaborative skills. I observed each of the case study teachers during team project
time and they demonstrated confidence while working with students. Some groups with
which I interacted and observed were challenging for the case study teachers in terms of
keeping everyone involved in learning. The case study teachers had to work through
student insecurities with collaboration in order for students to experience success. Most
of the groups in each case study teacher’s class finished the project—most of which
turned in a high quality product. Unsuccessful groups and students stood out, however,
in the teachers’ minds. Three of the four teachers showed insecurities in another skill
set—teaching language arts skills. All of the teachers except Peggy reported being
unable to provide adequate writing instruction or revision time for their students. Though
the case study teachers experienced insecurities in these two areas, they expressed and
displayed confidence in teaching collaboration and some were able to overcome or look
past their self-doubt in teaching language arts skills.

**Student collaboration: Playing nicely in the sandbox**

I have a class in which certain kids can’t work with each other, because they don’t
get along. I have groups of kids who should not work together because they get
along too well and won’t focus. I have kids that prefer to do it all by themselves.
They’re motivated and hardworking, but I need to help them learn how to work
with groups and not have a breakdown.

All expected difficulties with group dynamics, but saw the value in teaching students
collaborative skills. “There are not many jobs where you don’t have to interact with
people. Sixth grade science does not have any standards that require social interaction, but they’ll be more successful with social skills.” He expressed that teaching students to work together was an additional goal to the curriculum goals of the PBL unit. “My goal is to make them more effective communicators and more effective at working in groups.”

Prior to the PBL, Al was apprehensive about his ability to teach students collaboration skills, though he explained how he would go about teaching them. “I use inappropriate student interactions as a learning experience. They help students gain maturity and interaction skills. How much it will help them learn about rocks and minerals, I don’t know. It’s another skill that they need to be successful.” He explained that kids need practice with working in groups. One of the values of PBL to Al was that it highlighted the need for constant social skills practice.

After the PBL, Al described the need to implement social, writing, and collaboration skills in his classroom at the beginning of the school year. “There’s no sense in waiting until the end to do it.” It did not help to have collaboration in the PBL at the end of the year as much as it would have helped to institute group skills throughout the year.

In post-PBL interviews, Al said that he felt comfortable teaching social skills and thought that learning to collaborate was a benefit of PBL. “The major benefit of PBL is that the kids have to learn how to work in a group. When they’re working in groups, kids can realize and utilize their strengths.” Al described wanting his students to practice appropriate conversation “over and over, until it became second nature. . . . Teaching kids to interact with one another will make most of the groups work together better. You have to play nicely in the sandbox.”
Similar to Al, Kelly’s ability to teach collaboration concerned her, but she felt confident that she could find solutions to group issues. “With middle schoolers, you’re going to have groups that won’t go well. I just need to help the groups that are struggling.” Kelly explained that her experiences have made her more comfortable with teaching collaborative skills. Learning how to collaborate in her career helped her explain the reality of group work to her students. She told students that they may not work with a person whom they like, but they have to find a way to work together.

Kelly said that she was “somewhere in the middle” at teaching those skills—not great, but not awful. Kelly agreed that there was a place for social learning in her classes, but she did not use it that much. Though she was not overly confident in her ability to teach group skills, she had previously taken opportunities to talk to groups that were having social difficulties during projects. When a group had a conflict, she explained that she “talked it out” with them. If a group member was unhappy, she told him, “If you’re unhappy and you’re making the whole group unhappy, then it’s not going to be a good situation. Let’s try and figure out what we can do to make you happier, so then the whole group will be happy.” If she determined that the group was having too much difficulty, she would have the group members work in different groups.

Kelly explained that she set up her groups for success, having at least one strong student in each group, prior to the PBL. During the PBL, however, her students needed extra instruction on how to communicate effectively. Some of her struggling students became dependent on the strong student, rather than taking ownership of the project. “I feel like some of the kids struggle with communicating their ideas, sharing tasks, and
making sure that everybody is doing their part.” She explained that she needed to focus on group skills as significantly as she focused on the content.

Despite some students’ struggles during the PBL, Kelly thought that she was effective in helping kids research and work together. She was cognizant of groups’ needs and met with them in order to discuss the research process, as I witnessed during observations. Some groups would take her guidance and run with it, while others needed more one-on-one time. “I moved around from group to group, helping them the best that I could. If they still weren’t getting it, I pulled them up to my desk and researched with them.”

Unlike the rest of the teachers in the study, the sixth grade teachers at Marcy’s school had common group work expectations. Social studies standards outlined specific learning goals for students during group projects. The common expectations helped her manage group dynamics. Marcy used these standards in order to address group issues and the students came in to the project with an understanding of group expectations.

In addition to the group work standards, Marcy used the PBL unit rubric to create a checklist of questions. The questions were broken up between group members, she explained, in order to keep everyone on track. Marcy had a difficult time, however, with students thinking that they were “done” because they had completed their set of questions. “They didn’t understand, and maybe I didn’t do a good job of saying, ‘You all have to work together.’” Throughout the project students said, “My part’s done.” Marcy rebutted, “Is the whole project done?” They replied, “No, but my part is done, so I’m done.” Marcy reiterated, “Look at what your group still needs to do. You still have other things to do.” The students said, “Yeah, but I answered these three questions,” or, “I
typed my two paragraphs.” After that type of conversation, Marcy explained, her students sat and did nothing.

Collaboration was a struggle for some groups in Peggy’s classes as well.

We hit road blocks with partner work, especially in the writing . . . Both partners had to research and put their information into the paper. What I found out from the peer evaluation was, with some groups, one person took both papers instead of both of them working together to write out one paper. That one person took both of their notes and they created the paper. Not just doing all the typing, but actually wrote out the paper.

Peggy felt frustrated that the groups were failing to write together. Peer editing and collaborative writing were what she wanted and many of the groups delivered, but some groups relied too heavily on one member. Despite this “road block,” Peggy explained that she was comfortable with helping students research and collaborate during the PBL process.

**Language arts and revision time**

Marcy explained that she was uncomfortable with teaching writing and other language arts skills. Students in her class struggled with writing and she was unsure about how to assist them. “The language arts and writing parts . . . It was hard for me to give feedback to kids because, in my mind, their writing was just bad.” Even though she recognized issues with their writing, she was unsure about how to revise it. “I didn’t know until I was grading their writing at the end of the project. When it comes to typing, spacing, fonts, paragraph form, and things like that—grammar and language arts are not my
strengths.” Marcy assigned a rough draft, but did not have time to read them. She assumed the students had writing skills from their language arts classes, but found out that—when they turned in their final product—they were lacking in many areas. With the knowledge of her and her students’ struggles, Marcy said that she was open to the idea of a cross-curricular project. Marcy welcomed any help from a language arts teacher in terms of writing or time management.

Kelly was also having difficulties with finding time for proposal revision. There were portions of the proposal that Kelly thought could have improved with some feedback and rewriting.

I didn’t have enough time to give them feedback on their writing . . . I wish I would have had time to conference with the groups and tell them, ‘I read over your proposal. Here are some things that are not the best. Here are some things that I really like,’ and talk with them about what they need to do to fix it. When it is one person and you’re looking at thirty kids, it’s just too hard to do.

On the other hand, Kelly thought that the time she spent on the project was adequate. “They had enough time, and at the end, I was worn out from it. We had a lot of in-class time and did a lot. Maybe more time wouldn’t have been better.” Kelly explained that she could have done better with the timing and making opportunities to review students’ written work.

Al also wanted more time for student revision and reflection. Some of his students were able to experience the revision process, but others were struggling to turn in the assignment on time. He explained the benefit of revision for some students, saying, “I wrote down comments on their proposal and gave it back to them. Al allowed groups to
resubmit and they would take care of the things that were missing. Their scores were higher, because their work was done well.” In addition to grades, Al talked about the role revision and student writing has in assessing student mastery.

If they don’t demonstrate it, then they haven’t mastered it. That’s one of the reasons why I would have liked more time to review and revise. I would like some time to peer review, they make changes, and then come back to me. We ran out of time with the computers and my anxiety went up when we were getting down to the wire.

With the PBL happening at the end of the year and the limited time with technology, Al felt the pressure of completing the project. He did describe positive thoughts, however, on the overall quality of the students’ proposals. “There were several very well written proposals—answering the questions, not going off on tangents, specific throughout.”

Unlike her colleagues, Peggy was comfortable with teaching language arts skills and had time for revision. When we discussed teaching skills and knowledge outside of science content, Peggy explained that she felt confident with teaching students how to write. Many of the skills that were a part of the PBL had been taught in other classes (i.e. report writing was taught in language arts and social studies). Peggy felt confident in filling in the learning gaps from those classes. “It helped that science was not the only class in which they were writing papers or doing research. Our sixth grade team does a good job with teaching them how to research and write a paper.” Though Peggy felt successful in teaching students to write, she mentioned that she spent a lot of her time working on student writing skills. As described above, she also had difficulty with having students write together.
Student reflection and revision improved Peggy’s students’ writing and assessment scores. Peggy had students turn in rough drafts and she edited their papers. The students had to dig deeper into their thoughts about the content, Peggy explained. The rethinking and rewriting helped them remember the content. Peggy found evidence for this in their end of course assessments. Student assessments showed that they retained the information, because they scored well on the portion about rocks and minerals.

Altered Grading

One of the central tenets of PBL is the collaborative team concept (BIE, 2011). Teachers evaluate the groups’ cumulative products and efforts, rather than each team member. Although teachers assess students’ efforts and assist with group dynamics during the project, the final grade belongs to the group. All of the teachers in this study broke from the concept of collective grading, evaluating some students on their individual effort and output.

“They didn’t learn anything, so they don’t earn anything.” Al expressed apprehension to the group work and grading portions of PBL. He was having difficulty coming to grips with all students in a group earning the same grade. Prior to the PBL, Al told me:

I don’t want any person’s grade affected by what the entire group does. They all work hard together and get an A. They all deserve an A. If two of them work hard and the third one sits there like a bump on a log, the third doesn’t get the same grade.

After the PBL, Al was still convinced that some students failed to earn their groups’ grades. “Those groups that were working together, I graded them as a group.” He broke
the project down into its individual components for some groups, because they were unable to keep the project organized or keep track of who was doing what. “I got to the point where everybody was assigned a chunk of the report. Their grade came from that. I wanted to eliminate kids who did nothing, as compared to kids who wanted to do the whole thing.”

Kelly experienced similar frustrations, and made similar adjustments, as Al. “I made adjustments for the groups that could not work together. You had the kids who were not doing much of anything, so I assigned a specific section of the PBL to them and made their grade on that.” I also found evidence of altered grading in Kelly’s agreements with other participant teachers during the post-PBL focus group and conversations outside of interviews. For example, when Marcy explained, “We talked at the beginning about an all for one deal, but I didn’t do it that way. I didn’t think it was fair to some of the kids who worked hard, because other kids just sat there.” Kelly said, “I agree. I did the exact same thing.” Prior to the PBL, Kelly was considering grading each group as a whole. She determined, however, that she needed to break the project up for some groups in order to hold all of the students individually accountable.

Peggy was also uncomfortable with giving all groups a collective grade. She developed a peer evaluation system in order to adjust individual students’ grades. In addition to peer evaluations, she interviewed individual students and considered her own observations. “I wanted to see how much work one student put in versus another. I talked to the students, because I didn’t want to grade unfairly. I wanted to know that they really didn’t do any of the work.” She took off points or added points to a student’s grade, depending on the amount of effort exhibited during the project. Peggy was
uncomfortable giving a whole group grade, because of the feedback she received on the peer evaluations and her observations. Though she thought that the peer evaluation system was fair, she said that it took too much time and effort to develop individual grades for students and she wanted to rethink the grading process.

The dichotomy between successful and struggling students made grading groups a challenge for Marcy.

Middle school is such a hard age. Some of them are really coming in to their academic own, they own their work, and they’re ready to take responsibility. Then you have some of them who, mom is doing everything at home or they’re still relying on a lot of outside help.

The variety in student effort made it difficult for Marcy to quantify their learning. She tried to have all group members’ grades be the same, but she said that, “I have a really hard time with all for one, one for all.” Some of the groups, Marcy explained, were “one-sided” and students were failing to turn in their parts of the project. She decided to change each group members’ grade based on their amount of effort and output. The following scenario provides an example of this Marcy’s approach toward group grading.

On the day after the project was due, which was a Friday, a student—who I will call Bud—told Marcy that one of his teammates failed to do his part and turn in the group’s project. Marcy said that she would talk to Bud’s teammates about the project. On Monday, Bud came to school with the entire project complete. Marcy confronted the other two students on the team. According to Marcy, the conversation was as follows:

Marcy: “Do you have anything to turn in to me?”

Boys: “No”
Marcy: “Where is everything that you’ve been working on?”

Boys: “I don’t know, I lost it” and “I don’t know. I cleaned out my binder.”

Marcy: “Do you understand that what Bud is handing me right now is solely for his grade? You are going to get a zero because you have nothing to give me.”

Boys: “Yes.”

Marcy: “Are you sure?”

Boys: “Yes.”

Marcy: “You have absolutely nothing that you can turn in to me for some credit?”

Boys: “No.”

Marcy explained that she could not give them the same grade, because they had not completed the work. The two boys ended up with zeroes and Bud ended up “in the B or C range.”

**The Responsibility of Failure**

The teachers in this study placed the responsibility of failure mostly on the student. Three of the four participants explicitly stated this in their interviews and all of them agreed that students need to take ownership of their learning. Based on STEBI results and interview data, they believed, however, that teachers had some responsibility in the success and failure of students. All cases contain examples of the teachers struggling
with student motivation and work output. Though each teacher had students who were
difficult to motivate, the teachers’ methods of addressing these students varied.

Al was talking about students who were having difficulty in his classes during our pre-
PBL interviews, so I asked him about his concept of failure. “Failure is not an option,”
was Al’s response. He described how a student in his class that fails is responsible for
that failure, because of their lack of effort. “Failure is when the kid is unwilling to
attempt. If someone is working, I’ll help them, or I’ll get another student to help them.
For a kid to fail, they didn’t try.”

Al described how he “figured out” kids and addressed work output issues. Making a
personal connection was Al’s first attempt at motivating students. “I always try the
personal relationship and talking to the kid first. I work on some of the assignment with
them to see if it’s an ability issue or if it’s them not wanting to work.” Sometimes he
would give kids lunch detention, so they would have a quiet place to work and could
maintain focus. “I give them time where they’re not distracted by other things.”

Though most of his groups did well, our conversation continually fell on two students
that were struggling, one of which was in a group that Al had to separate. These students
were having a difficult time with contributing to their groups. Even after contacting
parents, Al was unable to coax a work product out of the students. “I talked to their
parents, worked with them, asked them questions, and went over what they were
supposed to be doing. I showed them where they could find information, and they still
didn’t turn anything in.” Al talked at length about how he was unsuccessful with these
two students. His worry over these students led him to conclude:
We have to teach the kids how to work in a group, but there are kids who, for whatever reason, don’t work. It’s not fair to place the extra work on the other children, if there’s going to be a child who can sit there and do nothing and still get the same grade.

Al focused in on one of the students who was having motivation issues during the PBL. “He was one of those kids in the PBL that was very comfortable letting everyone else do the work. He was in one of the groups that got divided. Afterward, he did his part well.” Al separated the student’s group and described the student’s reaction to his group’s hesitance in working with him. “None of his group members wanted to be in the half with him, even though two of them were his friends. They wanted to bail and work by themselves rather than with him.” According to Al, the student failed to register the reason that his friends were unwilling to work with him. He explained the reality of the situation to the student. “I put it right out there for him. Of course, the student thought that I was wrong, that I didn’t know what I was talking about.” Al was frustrated with this, but hoped that the student would benefit from the experience. “Eventually, maybe he’ll see and make adjustments to his behavior.”

Similar to Al, one of Marcy’s students was a perennial concern for her. She described how he was content to get a zero on a previous lab, because he knew he was able to get an A or B on the quiz. During the lab, Marcy told the student, “I just want to be clear. You’re making the personal choice to get a zero on this lab.” The student said “Yep.” Marcy let it go for about five or ten minutes, then asked the student “I just want to make sure we’re clear. You’re going to get a zero if you don’t do anything. Do you understand that?” The student said, “Uh huh.” He was not being disruptive, so she let him continue
to play. She felt that the zero would help him understand the consequences of his actions and emphasized that students should be able to make a personal choice. “If you’re choosing to sit here, that’s what you think is best for you—that’s your choice. You’re going to be the one that has to deal with mom, when you get a zero.” When I asked whether she thought grades motivated this student, she said there was external motivation, but not internal motivation.

The zero, to him, it doesn’t necessarily have an effect until somebody pressures him. Until mom was to say, ‘What are you doing? Are you crazy? This is unacceptable.’ Internally, he’s probably saying, ‘Eh, okay. I’ll get an A or a B on the quiz, and I’ll be fine.

Grades did not change his behavior or outlook on her class, which was the source of her frustration with this student. As shown in the “Altered Grading” section above, Marcy reacted similarly to a student motivation situation that occurred during the PBL. Students that fail in Marcy’s class are making a “personal choice.”

When I asked Peggy about the STEBI prior to the PBL, she launched into a story about a student who was struggling and how she was unsure why some students underachieve in her class. “We always go back and forth when we have underachieving students. Why are they underachieving? Is it because of something that I’m not doing, or are they not putting forth effort?” The student, who Peggy was worried about, was failing her class and she was struggling with the reasons behind his failure. “It’s him failing my class, and me trying to figure out what is going on. He gets the same information as everyone else but, once he leaves class, I never see anything completed.” Peggy tried to assist the student in a plethora of ways, including calling parents, creating
a checklist that his parents have to sign, and repeatedly giving him materials. Nothing that she did worked. “When you feel you’ve given your all and you still have someone fail, it’s disappointing, but I did what I could do.” In connection to this conversation, Peggy disagreed with statement seven on the STEBI, “If students are underachieving in science, it is most likely due to ineffective science teaching” and statement fourteen, “The teacher is generally responsible for the achievement of students in science.” She was also undecided on statement fifteen, “Students’ achievement in science is directly related to their teacher’s effectiveness in science teaching.”

Peggy put further blame on the amount of time the student’s parents were available to assist the student. “It’s lack of parental involvement. Mom has the twelve-hour overnight shift. When you ask what he does at night, it’s play video games. Dad’s home, but he works during the day, so he’s asleep.”

The student was successful with short-term assignments and quizzes that he can immediately turn in, but long-term assignments and tests were often difficult for him. When I asked Peggy if he was learning in her class, she said,

If you look at quiz scores, not test scores, they are usually in the C-minus/B range, so something’s going in. When it’s test time and it’s everything from the unit, because that practice isn’t there and he’s not doing the homework, he has difficulty. When it comes to applying knowledge, that’s difficult for him as well.

The classwork or quiz that I give today and is due today—he’s good.

During the PBL observations and interview process, I had conversations with Peggy about how she helped unmotivated students complete the PBL. As I discussed in Chapter IV, Peggy had a high amount of rapport with her students and she used it to motivate
them. When rapport was not enough, she met with groups and had conversations about group responsibilities. In the post-PBL focus group, she described her reaction to students who were not doing their part:

I called people out. I said, “You’re not doing this. Why are you not doing this? What should you be doing?” It may have taken one or two conversations. The first conversation I would say, “If you don’t have this done by tomorrow or the next day, you’re parents are going to get involved.”

Despite her best efforts, however, some students failed to produce effort or quality work products. Evidence, presented in the “Altered Grading” section above, shows that some of her students were penalized for their lack of participation and output.

As I described in Chapter IV, I experienced Kelly’s reaction to struggling students first-hand. In my second observation of her classroom, she sat me next to a group for which she had concern. Two of the group members were dodging their parts of the project, providing little output for the group. Kelly had given one of them—who I will call Steve—homework, which he failed to complete. Steve said he had the information “in his head.” Kelly quickly responded, “We need to get that done and, if the research is in your head, you will tell it to your group, right?” She gave him homework, Kelly later told me, because she was “trying to keep him on track.” In order to keep Steve focused, Kelly offered multiple prompts for him to stay on task and initiated the assistance of one of his group members and me. The leader of the group, upon Kelly’s request, supplied him with tasks and checked on his progress. I helped the group develop their thoughts and keep focused, which was Kelly’s purpose in sitting me next to them. Two teachers and a peer were actively involved in keeping Steve on task.
During the PBL, Kelly frequented some groups more than she frequented others, because of some students’ difficulties with understanding or completing tasks. When I asked Kelly how she balanced helping students versus letting them figure things out on their own, she explained that it depended on the student or group. If students were perennially experiencing failure, she was more likely to offer assistance at the first sign of struggle. “I don’t want them to constantly feel like failures, so I step in quicker than the others that I know haven’t experienced a lot of failure and will get there.” Ultimately, she thinks that it is her responsibility to help. When I asked her why she felt that way, she said, “I don’t want them to be disappointed. I don’t want them to feel like they failed.”

**Changing the PBL Project: Is There a Right Way?**

Prior to the beginning of the PBL, all participants entertained the idea of changing the PBL. If the PBL was going wrong, changing and stopping the project were options. All participants were willing to make adjustments based on their students’ reactions to the project. Marcy was the only teacher who was willing to stop the PBL permanently. The other teachers thought that they might need to stop the PBL for a short time—returning to the PBL after teaching a small amount of content. Fortunately, none of the teachers stopped the PBL completely. They all, however, changed some aspects of the PBL and wondered whether they were “doing the PBL right.”

If something goes wrong during the PBL, Kelly plans on diagnosing the problem and making adjustments. “I’m sure the whole thing is not going to be awful, but it may require finding out what areas the students are struggling with and stopping for a
second.” Though Kelly described stopping the PBL in order to teach content, she determined that she could always salvage the PBL. As with other situations, Kelly would work through problems with her students. “Let’s talk about this part and see if we can figure this out together.”

Changing the structure of the PBL was also an option for Al. With the nervousness that Al felt about the final product, process, and student collaboration, he explained that, “if it’s not working completely, then we need to adjust. Teach them content and say, ‘Now, back to our PBL.’” When I probed further, Al reiterated the idea of stopping the PBL. “If it starts going wrong, I can always fall back on teaching the individual lessons, tweak it to make it more interesting, or find a guest speaker to come in and talk about things.”

Al was uncomfortable because he was unsure about his ability to see the need for adjustments. “I hope that I am able to see what’s happening and make changes, so the kids are getting a good learning experience out of it.” He went on to describe leading some students or groups through the PBL systematically, adding, “They may need more basic information, or more scaffolding, before they can move on.”

As described in their cases and in the “Altered Grading” section above, Kelly and Al made adjustments to the PBL. Many of their adjustments mirrored each other. They retaught content based on their students’ needs, periodically “pausing” the PBL. Kelly, occasionally, spoke as if PBL and content learning were separate. Making statements such as, “Today is a content day. We will be working on the PBL tomorrow.” The cost section was difficult for their students to accomplish, so they decided to make it extra
credit. They were confident that they made necessary changes in order for their students
to be successful.

Prior to the PBL, Marcy considered reverting to her old way of teaching material and
completing projects. She said she would separate the content from the project—teaching
the content first, and then having students create a project. “Let’s learn about these
subjects. Now we have all of the knowledge that we need about rocks, we’re going to
start this project.” Only a drastic disaster would cause her to do this, however, and she
was confident in her ability to keep groups on track.

If everybody were lost, then we would have to separate the content and the
project. If we’re talking about one or two groups, or five groups out of a hundred,
then I’m just going to meet with those five. I’ll continue on with everybody else,
and figure out what the issue is with their group.

During the PBL, Marcy developed a question list based off the rubric—as mentioned
in the first theme—and had periodic meetings with each group. The question checklist,
however, backfired for “half of the groups,” because a creative project became a typical
worksheet. Marcy described her frustration with groups treating the project like a
checklist. “Half of the groups did well, grasped the idea, and ran with it. Half of the
groups just followed the checklist and that was it.” There were groups that would turn in
papers with “yes” and “no” for some of the questions on the checklist, putting little
thought into the project.

In my first conversation with Peggy, her advanced class was the only class that was
going to complete the entire project, including building a model. She talked about
“scaling down” the PBL for her other classes. “I’m only doing the PBL with one class,
starting out. I don’t think I’ll build with my other classes, but I want to try with my advanced kids.” Tweaking some aspects for her inclusion class was prevalent in her description of the PBL process. “I was trying to figure out ways to pull it into my inclusion class. Scaling it down a bit, creating a pamphlet or a poster with a partner instead of building their own monument. Ideas are bouncing around my mind.”

Despite her original thoughts of scaling it down, Peggy performed the PBL with all of her classes. She started the advanced class earlier than the others, but did the same PBL with all of her classes. “I’m going to try it with all my kiddos. It’s all set with student council and our principal’s name is on the intro letter. We’re ready to rock and roll.”

Peggy’s only changes to the PBL were described in the “Altered Grading” section of this chapter.

Throughout the study, each teacher expressed worry over “doing the PBL right.” I asked Peggy if she thought there was a right way to do a PBL and her answer summarized the perspectives of each teacher within this study.

A right way? That question was asked to me last week, when I was going over some of the PBL with our gifted education coordinator. She asked, “Is there a right way?” And, I looked at it and I’m like, “I know what the final outcome can be, but as far as there being a right way or wrong way, I guess not.” It’s just about the final outcome and you’re taking those baby steps to get there. As long as we get there, I guess there is no right way.

Teachers in this study echoed Peggy’s assessment, focusing on the outcome of the PBL. If the outcome met their expectations, the process could not be wrong.
Confidence within Collaboration

Three of the four participants cited collaboration within their schools as a source of confidence. They enjoyed having people in their room who helped them teach and people in their school who helped them plan and work through roadblocks. Marcy was the only teacher in the group who was “on an island,” because teachers at her school were not attempting the PBL. Having no one in her school with whom she could collaborate made her more nervous about the project than the rest of the participants. She did feel more confident, however, having me and the other teachers in the study as a resource.

Co-teachers allowed Kelly to use her time efficiently. She felt that having another person in the room, who supported the students, made her stress level decrease, and gave her more one-on-one time with students. “The intervention specialist was in some of my classes, so I felt like I could get around to more kids. When there’s no one else in there, it’s hard.” She welcomed anyone that came into her room, because she used them as a resource for student learning. I experienced this comfort and openness in both of my observations of Kelly and her students. As soon as I entered the room, she wanted me to be a part of the learning process. When I asked Kelly why she was comfortable with having other people in her classroom, she said, “I feel confident in my ability. I’m not thinking, ‘What is he going to think about me?’ Having that confidence and knowing that I’m doing the best that I can, I might as well have you come in and observe.” She explained that, in her first year of teaching, she would not have wanted others in the room, because she was finding herself as a teacher. Now that she knows herself, she welcomes any assistance or observer.
Collaborating with Al generated a tool that made it easier for Kelly to keep track of the projects. “Al had created a table with all the groups, what rocks they had chosen, and why they had chosen them. As we were going through the process, I’d fill in little things, so then I’d remember.” Using the chart, Kelly was able to organize information about her students. Kelly and Al typically collaborate in this fashion. During the PBL, Kelly and Al kept a similar pace and they consistently shared their experiences and insights.

Similar to Kelly and Al, Peggy had support at her school and within this study. She worked with the gifted education coordinator in order to prepare the PBL for all of her classes. Two teachers at Peggy’s school were also completing the PBL—neither teacher was in this study.

It’s all here. It’s laid out. You have to jump in and go. I’m confident because I know that I am not the only person doing this. I can call somebody or email you and say, “I need help!” The teacher next door is starting the PBL soon. He’s been teaching rocks and minerals forever, so he can help me. Having people around and knowing that the steps I need to take are there, the support system is there—we’re good.

Having a content expert in her school and the participants in this study in contact was comforting. Peggy was confident with teaching the PBL, because of support from her colleagues.

All of the participants mentioned the value of having me as a collaborative resource. Prior to the PBL, I described my experiences to the participants, showed them my lesson materials, and explained how I went through the process. Al and Kelly taught in my building and were able to come to me with questions and concerns about the PBL or their
students. As mentioned in the paragraph above, Peggy was willing to email me in order to get help. She also mentioned that I laid out everything in front of her and the rubric was “her best friend.” Marcy was grateful that I was available for advice both during and after the PBL. Before and after each interview with Marcy and Peggy, we spent anywhere from ten to thirty minutes discussing the PBL. They picked my brain about my experiences and asked questions about the process. Additionally, observation data were evidence of their comfort with collaborating with me. During many of the observations, the teachers had me work with specific students who were struggling with the project. They trusted me to support their and their students’ learning.

Multitasking Facilitators

All of the teachers felt confident in their ability to multitask. Kelly’s comment about multitasking summarized each participant’s experience while teaching the PBL: “During some periods it was crazy, with the technology issues and this student wanting this, and this student wanting that. But, I think we do that as teachers, so it’s just natural, I didn’t even think twice about it.” As I observed each teacher, I noticed an ability to handle multiple issues, questions, and tasks almost simultaneously. Every group—and at times every student—were doing something different during the PBL and each teacher was able to keep up with the flow of the class.

In addition to multitasking, Kelly explained that her role within PBL is that of a facilitator. Rather than relying solely on direct instruction, she helped the students navigate the content and learning process. Support and guidance were her two main tasks as a teacher—showing students how to answer their questions and providing activities
that help them understand the content. “Guiding them through research and their learning about different types of rocks is important. I’m not saying standing up in front of class and pouring out information, but finding activities in which we learn together.”

Though Marcy was uncomfortable with giving the students too much freedom, she enjoyed “stepping back.” As she described in Chapter IV, she had experience with the facilitator role during the PBL. She explained that there needed to be a balance between teacher and student directed learning, but recognized the benefit of “letting students go.” She was pleased with her students’ abilities to ask each other questions and help each other learn. During my observations, I witnessed her encouraging students to ask each other questions and helping students through the research process.

Peggy also described herself as a facilitator within the PBL process. When I asked Peggy why she was facilitator, she explained that she always puts herself in the student’s seat. Hearing lectures all day would be boring and lead to her and her students zoning out. She, therefore, exposed her students to hands-on, minds-on activities—both inside and outside of the PBL—that allowed them to experience learning.

Peggy’s middle school years lacked such experience. She told a story about her eighth grade science teacher doing a frog dissection, which became the foundation of her belief in experiential learning. Being a science enthusiast, she was excited to get started with the dissection. They had one frog, however, and the teacher was the only one dissecting it. Peggy sat there for the entire dissection, coloring in frog parts on a worksheet.

It was pointless to me—boring. As she took things out, we would color it in and label it on a piece of paper. It proved absolutely nothing. The only thing I remember about that frog was that I didn’t get to touch it. I couldn’t tell you the
parts of the frog. I couldn’t tell you where things were until I got to high school and started to dissect things on my own.

**My Cross-Case Theme Experiences**

**Collaboration and failure**

Collaboration was a difficult concept for some of my students during the PBL. Their difficulties, in turn, led me to doubt my ability to teach them group skills. As with my colleagues, the majority of my students were successful during the PBL. They created high quality products and worked as teams. Almost every group had bumps in the road during the PBL and I was confident in my ability to keep them functioning. One group, however, failed to stay cohesive.

The following is a story about my struggle with group dynamics and a student’s responsibility of failure, as I told it to Marcy:

A group of three—two girls and a boy—started the PBL working well together. They had some disagreements and the boy stopped working. He said he wasn’t going to do anything and didn’t want to be part of the group anymore. The group and I had meetings and I talked to him individually, but it never came out as to why he didn’t want to be a part of the group. He kept repeating that he didn’t want to do anything and he did not care. I found his behavior odd, because we had typically gotten along and he typically did well in my class—both academically and behaviorally. So, I talked to his Grandma, who was his guardian. I talked to the intervention specialist, with whom he regularly worked
because of an emotional disability. His Grandma said she would try to get him to work on the project at home and the intervention specialist said that he was refusing to work on it in their room as well.

After a few days of him refusing to help the group, I told him, “It’s to the point where you need to do something or you’re not going to be a part of this group. Your other teachers and I have tried everything—we’ve talked to you, had group meetings, talked to your grandma, talked to your other teachers. You and I usually get along and you do well in my class. I don’t know what’s going on and you won’t tell me. If you’re not going to help, then you’re not going to be a part of this group. You’re going to do the whole thing by yourself. So, you need to decide right now what you want to do. We can talk to your group, see what they need to get done, and you can help them with it. Or, you can do it on your own.”

He said that he wanted to talk to them. They asked him to do a few parts of the project and he worked for the rest of the period. The next day, he sat there and did nothing for the first twenty minutes of class. I pulled him aside and I said, “We’re going call your grandma and you’re going to do this project on your own. You are now a group of one.”

He worked on his own in a room with the intervention specialist and turned in a project that met a little over half of the requirements. I was disappointed, because I wanted him to learn how to work with his team. He failed at collaboration, which made me feel like I had failed. Upon further reflection, I was pleased with the way that I handled the situation. I did everything in my power to keep the group intact and he completed part of the project, which was more than his contribution to the group. He was responsible for
his decision, but I was responsible for putting him in a position in which social and academic learning—at least a small amount—was possible.

**Teaching language arts skills**

Revision and reflection time for my students was a priority during the PBL process. I built two rough draft due dates into the project calendar and provided detailed written and oral feedback on each draft. Most students’ final proposals were less than perfect, but each draft showed improvement. What I found most exciting was having the students compare their two rough drafts with their final draft. We wrote a reflection and discussed the progress that they had made throughout the project. My experience was in line with Peggy’s in terms of this cross-case theme, because we both offered students time to think about their learning and improve their writing.

**Collective grading**

Each group earned a collective grade in my class. Unlike the teachers in this study, I refrained from adjusting grades for individual students. If a student lacked effort, their group or I would call for a group meeting. The students aired their grievances and we discussed possible solutions. I would follow up with the group in order to ensure that our solutions were working and make necessary adjustments. If one student was the leader of the group and other members were not pulling their weight, I would tell the leader that she was in charge of the other members. For example, I told one group, “Whatever she tells you to do (speaking about the group leader), you do it now, no questions asked.” Then, I told the group leader, “Don’t be rude to them, help them out, and let them know...”
what to do in order to get this done. If they don’t do what you ask them to do, let me know, and I will take care of them.” Occasionally, it was necessary to call a student’s parents about their child’s behavior. In one extreme case, I required a student to complete the project on his own (see the “Teaching collaboration skills and the responsibility of failure” section above). In past projects, I have altered individual grades to represent individual effort or work output. I graded each group collectively for this PBL unit, because I wanted my students to become a team—working collaboratively and supporting each other.

Confidence within collaboration

The participants and I had similar experiences within this cross-case theme. Similar to Kelly, I had an intervention specialist in one of my classes. Having another person in the classroom, who provided guidance to the students, allowed me to use my time efficiently. I was able to address group issues more thoroughly and follow up with groups more often than the class in which I was the only teacher. Like Al, Peggy, and Kelly, having colleagues within my school who were completing the PBL comforted me. I also found comfort in being a part of this study, as did the other teachers. Being able to talk about the process, share ideas, and problem-solve together increased my confidence in my ability to teach the PBL unit.

A heightened awareness of my role

I am a multitasking facilitator, whether I am doing a PBL or not. Kelly’s description of multitasking during the PBL resonated with my experiences. When I teach, I am in a
perpetual state of multitasking. The PBL heightened the hectic feeling of multitasking, because students were performing multiple, different tasks every day. During the PBL, students constantly tested my facilitation skills. Some of the students would beg for “the answers” and, most of the time, it would have been easy to give them “the answers.” Similar to Marcy, I enjoyed “stepping back” and letting students solve problems—only answering questions directly when it was appropriate. My role in the PBL, however, was to guide students towards success, rather than providing them a direct route to success.

**Comparison of Case Study Participant STEBI Results**

When comparing the case study participant STEBI data, Al was the only case study teacher that had a decrease in his STEBI scores (see Table 5.2). He also changed more responses to undecided than the other case study participants did (see Tables 5.2 and 5.3). This may indicate that Al became unsure of himself as he carried out the PBL process. Evidence for this assertion was also present in the interview data. Prior to the PBL unit, Al was confident in his and his students’ abilities to complete the project, but uneasy about how the process would unfold. After the PBL, Al was unsure about his ability to teach, and his students’ aptitude at, problem solving. He explained, “It makes me nervous when I’m having the kids do it. They come up and tell me what they’re learning and some of it is not right. I start worrying, ‘Am I helping them out?’” He also described his view of students as problem solvers, saying, “I don’t think they’re great problem solvers, or with their developmental state, they’ll be great problem solvers. It’s something that I question myself on.” Al’s assessment of student problem solving skills may have led to uncertainty in his STEBI responses and overall decrease in STEBI score.
In 2005, Cardwell measured teacher self-efficacy as they completed a professional development program. After one year in the program, she found that some of the teachers experienced an overall decrease in self-efficacy scores. Based on findings from Bandura’s research, she deduced that the self-reflection and realization process within the program might have influenced these teachers’ efficacies. Al’s reduced self-efficacy score may be associated with a similar experience. During the PBL process, teachers in this study were involved in interviews, observations, and taking surveys, in which I asked them to reflect upon their practices and beliefs about teaching, learning, and their self and collective efficacies. Through self-reflection, Al may have begun to question his beliefs and abilities. Some of the difficulties and insecurities that other case study teachers had in this study, as described in Chapter IV and early in this chapter, may have also been a product of self-reflection and questioning their practices.

Marcy, Peggy, and Kelly’s STEBI scores increased slightly from pre- to post-PBL, with Peggy’s score being the highest on both pre- and post-PBL STEBIs (See Table 5.2). Possible explanations for Peggy’s efficacy scores could be the support she received from colleagues during the PBL, her and her students’ experiences with inquiry prior to the PBL (i.e. her monthly design challenges), and her previous experience at a charter school. Marcy and Peggy had the same amount of undecided responses on pre- and post-PBL STEBIs, while Kelly’s amount of undecided responses decreased from eight to five (see Tables 5.2 and 5.3). Prior to the PBL, Kelly described her nervousness about the new curriculum, the availability of resources for the PBL project, and her ability to be a content expert. She was glad that other teachers were participating in the PBL and she was not the first one completing the project. After the PBL, she described the process as
“natural and easy.” Student successes and support from her colleagues eased her concerns about her performance in using PBL, which could have affected her STEBI scores and undecided responses. Kelly’s description of her approach to new teaching methods supports the STEBI results concerning her reduction in undecided responses. She stated, “I get a little nervous that it won’t be good, and I’ll waste a week or two on something that wasn’t helpful to my kids. Usually when I get in it, it’s okay and I work through the problems.”
Table 5.2

*Case Study Participant and Non-Participant STEBI Response Scores*

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<th>Al Pre Post</th>
<th>Peggy Pre Post</th>
<th>Marcy Pre Post</th>
<th>Kelly Pre Post</th>
<th>Non-case study participants Majority</th>
<th>Average</th>
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Total score 92 90 100 102 94 96 93 96 101 95
Total undecided responses 3 6 3 3 1 1 8 5 0 6
Table 5.3

Case Study Participant and Non-Participant STEBI Responses

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<th>Al Post</th>
<th>Peggy Pre</th>
<th>Peggy Post</th>
<th>Marcy Pre</th>
<th>Marcy Post</th>
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Note. Response percentages for non-case study participants are in parenthesis.
Table 5.4

*Case study participant and non-case study participant average STEBI scores*

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<th>Case study participants</th>
<th>Non-case study participants</th>
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<tr>
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<td>Pre-PBL</td>
<td>Post-PBL</td>
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<td>Average STEBI scores</td>
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**Comparison of Case Study Participant and Non-participant STEBI Results**

As shown in Table 5.2 and Table 5.4, the average STEBI score for the case study and non-case study participants were similar. Average post-PBL scores for case study participants were slightly higher than average scores for non-case study participants. When considering the majority responses for the non-case study participants, their total STEBI score (101) is higher than the individual case study participants’ post-PBL total scores, except for Peggy (see Table 5.2).

While there was little difference in the average STEBI scores, there were five statements on which the majority of case study participant and non-case study participant responses differed (see Tables 5.3 and 5.5). As Table 5.5 shows, four of the five statements on which the case study teachers and non-case study teachers responded differently focus on student achievement. When analyzing statements thirteen and fifteen, the case study participants appear unsure of the effects teachers have on some students’ achievement. On the other hand, the majority of non-case study participants believed that teachers had an effect on student achievement. When the statements were about low achievement scores and motivation (i.e. statements ten and twenty), however, the majority of the case study participants believed that teachers had an effect on student achievement. The majority of non-case study participants thought that teachers could not
be blamed for low achievement, particularly for students with low motivation. As shown in the cross-case themes above, case study participants experienced students/groups that were unmotivated during the PBL. Their responses toward these students varied, but all of them believed that their efforts had an impact on these students’ achievements.

Statement twenty-five on the STEBI, for which case study participants and non-case study participants also had different responses, concerned student learning. As shown in Table 5.5, the majority of teachers in this study believed that good science teaching abilities lead to student learning. The majority of teachers who were non-case study participants, however, were unsure about the effect of science teaching abilities on student learning. The case study participants, as described in this chapter and Chapter IV, were concerned with student learning and believed that content acquisition was a major goal within PBL. I cannot necessarily attribute these data to the participants’ PBL experiences, however, because individuals responded similarly on both pre- and post-PBL STEBIs.
Table 5.5

*Differences in majority responses of case study and non-case study participants*

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<th>STEBI Statement</th>
<th>Majority response of case study participants (n=4)</th>
<th>Majority response of non-case study participants (n=11)</th>
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<tr>
<td>10. The low science achievement of some students cannot generally be blamed on their teachers.</td>
<td>Three of the four participants were undecided on the post-PBL STEBI, Marcy agreed on both</td>
<td>64% Agree, with 18% undecided</td>
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<td>13. Increased effort in science teaching produces little change in some students’ science achievement.</td>
<td>Two of the four participants agreed on both pre- and post-PBL STEBIs</td>
<td>55% Disagree, with 27% agreeing</td>
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<tr>
<td>15. Students’ achievement in science is directly related to their teacher’s effectiveness in science teaching.</td>
<td>Two of the four participants disagreed on both pre- and post-PBL STEBIs</td>
<td>64% Agreed, with 18% disagreeing</td>
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<tr>
<td>20. Effectiveness in science teaching has little influence on the achievement of students with low motivation.</td>
<td>All participants disagreed</td>
<td>46% Disagreed, with 36% agreeing</td>
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<tr>
<td>25. Even teachers with good science teaching abilities cannot help some kids learn science.</td>
<td>Three of the four participants disagreed or strongly disagreed on pre- and post-PBL STEBIs, Kelly was undecided on both</td>
<td>46% Agree, with 27% undecided</td>
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**Summary**

Within this chapter, I described six cross-case themes—derived from the categories present in interview, observation, and artifact data (see Table 5.1). I summarized, and provided examples of, my experiences in connection to the cross-case themes. The chapter ends with a comparison of participant and non-participant results from the STEBI. In the next chapter, I will explain how the themes connect to my research questions, conclusions from this study, and the implications of this study on education and research.
CHAPTER VI

CONCLUSIONS AND IMPLICATIONS

Introduction

This chapter begins with a restatement of the purpose, research questions, and methodology of this study. I, then, provide a synopsis of case study teacher experiences and cross-case themes that addresses my first research question. In order to address the second research question, I connect the cross-case themes with PBL’s effects on efficacy. Differences in individual participant teacher efficacies are also discussed. Finally, I reflect on the implication that this study has on future research and educational practices.

Restatement of Purpose and Research Questions

The purpose of my research was to describe and understand teachers’ experiences while trying a new teaching method and the impact it had on the participating teachers’ self and collective efficacies. There were two research questions in this study: (a) How do middle school science teachers experience the implementation of PBL, and (b) How is the implementation of PBL related to perceived teacher self and collective efficacy? The first research question focused on the teachers’ experiences, which I described in Chapter IV and V. In order to address my first research question, I provided a synopsis of the teachers’ experiences within this chapter. I also discussed their individual and collective experiences in connection to their efficacies and the literature from Chapter II—which addresses my second research question.
Review of Methodology

Phenomenological case study was the methodology used in this study. Four middle school science teachers implemented PBL with their students, participating in interviews and observations that focused on their experiences and efficacies. Phenomenology was appropriate for this research, because the teachers’ experiences were the core of the study. Each teacher was participating in the same phenomenon—attempting a new teaching method for the first time. As I will discuss later in this chapter, the themes presented have uncovered at least part of the essence of this phenomenon. Including case study methodology allowed me to focus on each teacher as he or she implemented PBL. Phenomenological case study methodology promotes the thick description of experience as it is experienced. As mentioned in Chapter III, there are researcher and participant biases within this type of research. Through triangulation, member checking, peer review, and negative case analysis, I increased the trustworthiness of my data and analysis.

Research Question One: A Synopsis of Case Study Teacher Experiences

In order to address my first research question, I have provided a synopsis of the case study teachers’ experiences from Chapter IV. I summarized their pre-PBL interviews, post-PBL interviews, observations, and within-case themes. After the individual case study summaries, I provided a synopsis for each cross-case theme.

AI

Pre-PBL interviews. AI stated, “The general definition of PBL is that you have an overall project goal that the kids have to accomplish. The goals connect to learning
targets that the kids have to master in order to accomplish the goal.” He liked the idea of PBL and was confident in his ability to teach it, but he was uncertain about the process and final products. This uncertainty made him nervous about the PBL.

**Post-PBL interviews.** Al continued to like the idea of PBL after the project was complete. He was willing to perform PBL projects and he thought that they were more challenging to his students than traditional projects. He felt confident in his ability to teach PBL, but lacked confidence in his ability to create a PBL without help from colleagues. Any PBL project that Al attempts would have to “make sense” to him before he tries it. He also described setting up a cross-curricular PBL with teachers from other content areas.

**Observations.** During observations of Al and his students, I noticed that Al designed his room for collaboration and student interaction. Al clustered tables into groups and met with each group in order to discuss their progress and next steps. My second observation demonstrated Al’s ability to promote student interaction, as students hands flew up in the air to read portions of the textbook using a karaoke machine microphone. He helped students learn content that they were misunderstanding in their research.

**Within-case themes.** I recognized the following three within-case themes for Al: (a) the thought process; (b) reality versus creativity conflict; and (c) humor, rapport, and classroom management. Al described the thought process as critical thinking and problem solving—skills that students could use in any context. Though Al saw value in the thought process, he was uncomfortable with its “messiness” and was frustrated when faulty thought process led to student misconceptions. The reality versus creativity conflict showed Al’s uncertainty about the direction of this PBL project. One option was
calling in an expert or providing the students with information that would limit their research to the few types of rock that could be made into a statue. The other option was to invite student creativity in their rock choices, allowing students to choose rocks despite their rarity or cost. Al was torn between these two options, but he ended up basing the project in reality. The final within case theme for Al became present when I saw him use humor with his students during my observations. Al explained that humor does not help him with classroom management, but does help build relationship with his students. During observations, I witnessed his humor causing mixed reactions from his students. Some smiled, while others frowned and glared, as he involved them in his humor.

**Peggy**

*Pre-PBL interviews.* Peggy described PBL as “learning as you work, learning as you do. Diving in and getting your hands dirty. Literally.” Prior to the PBL project, she expressed that she appreciated PBL because it encouraged the application of knowledge and helped students retain content and learn collaboration. Peggy was a believer in student interaction and reflecting on group situations. Although Peggy had little experience with PBL, she regularly implemented inquiry-based learning in her classroom. She was confident in her students’ abilities to handle PBL, because of the monthly design challenges in which her students participated. PBL success, Peggy said, would happen “if they walk away with the knowledge” and if she learned what to change for next year.

*Post-PBL interviews.* After the PBL, Peggy explained that she put too much pressure on herself at the beginning of the project. It was easier than she expected, she believed that she already used the processes within PBL. As described above, inquiry learning
was a staple in her classroom, which prepared her and her students for the challenges of PBL. Two benefits of PBL stood out to Peggy: (a) she and her students saw the textbook as one of many resources and (b) her students with special needs increased their efforts during the project.

Observations. When I observed Peggy and her students, I noticed the power of her rapport. She used positive language with her students, encouraged them to keep trying, and connected with them on a personal level. I asked Peggy about rapport with her students and she explained that rapport was the reason that students were willing to try new things—like PBL. “If I was someone they did not get along with and I said, ‘Okay, we’re going to try this,’ they could put up a resistance. It’s all about how you present it.”

Within-case themes. The three themes that I recognized within Peggy’s case study were: (a) learning with her students, (b) homework for points, and (c) prayer and tears. “I’m a better teacher when I learn with them.” Peggy described changing what she does every year in order to stay fresh and how learning with students “makes me human.” In the second theme, I wrote about Peggy’s thoughts on homework, which colored her outlook on teaching and learning. As a new teacher, Peggy included homework as a grade because of her veteran colleagues’ encouragement to have a large number of points at the end of the grading period. She came to understand, through professional development sessions, that homework was a part of the learning process and was formative, rather than summative assessment. The last theme details a source of Peggy’s confidence. Her first teaching assignment was in a charter school, with very little resources. The struggles and successes that she had in this position gave her confidence to take on new challenges.
Marcy

Pre-PBL interviews. PBL “seems like a good idea in theory.” PBL was a “haunted house” to Marcy. The anticipation was more nerve-wracking than participating in the process. Prior to the PBL, Marcy was contemplating the point of PBL, and its classroom application. She understood that classrooms were becoming more student-centered and she wanted to follow this path. The fact that she was the only teacher in her building attempting PBL and she was unsure about the district’s support with PBL enhanced her “haunted house” feeling. Despite her doubts, Marcy was encouraged that PBL focused on the application of knowledge, rather than the “spitting out” of knowledge. Engagement and application symbolized PBL success for Marcy.

Post-PBL interviews. “It pushes them to grow up and change the way that they’ve been thinking, but I don’t think that they gained more knowledge about rocks from the PBL.” Marcy compared teaching the PBL with other teachers within the district who taught detailed vocabulary without PBL. She believed that her students were losing part of the content, but gaining thought process that would help them in future science classes. Marcy also enjoyed “stepping back” and giving the students more freedom to explore learning. Though she was uncomfortable at times, she said, “It was good to see that I could step back in some classes, and they could continue to ask questions.” Marcy gave her best effort and took exception with the idea that implementing PBL was “above and beyond” what she was supposed to do for her job. She explained that she changed the way she did things, not the amount of effort she put into her work.

Observations. Marcy swung between teacher- and student-directed learning. There was a lesson in which she had the students taking notes in a systematic fashion. She then
offered a rock cycle game—which let them choose their path through the rock cycle. During my second observation, student groups were researching and compiling information for their proposals. Marcy assisted students with research and checked their work. She was more “hands-off” in this observation, stepping in when students were struggling with staying on track or meeting their goals. When students were lacking effort or work production, Marcy would step in and create goals/tasks for them.

Within-case themes. I recognized three themes specific to Marcy’s case study: (a) student experience with inquiry and critical thinking, (b) balancing the amount of structure, and (c) comparing herself to others. During the project, Marcy recognized a difference between her advanced and intervention classes. Students in her advanced class were more comfortable and competent with critical thinking than students in her intervention class. She attributed this difference to their ability to use, and experience with, inquiry and critical thinking. Students in her intervention class were used to “following the directions,” while students in her advanced class were able to apply their knowledge. Marcy also wanted a balance between structure and looseness in her teaching. She added more structure to the PBL than I had built in, mapping out student activities on the PBL calendar and changing the PBL rubric into a set of questions. A lack of structure would not work for her, Marcy mentioned, but “on the other end, I would have so much backlash from the kids that being a control freak wouldn’t work either.” Throughout the PBL process, Marcy was concerned with people—including me—comparing her to other teachers. She explained that she often doubted herself and she being honest on the STEBI was difficult. “There are some things on the STEBI that,
some days, I strongly agree with. There are other days where I don’t agree—I could have done things better.”

**Kelly**

*Pre-PBL interviews.* Content was the king of Kelly’s PBL world. She believed that PBL would engage her students and help them learn 21st Century skills. Content mastery, however, remained her ultimate goal. Despite having little professional development with PBL, she felt that colleague support would increase her chances of success with this project. Content and resources were a source of stress for Kelly. With the content being new and resources being limited, her confidence waned. She felt that she had to be “more of an expert than the kids.” Planning for the PBL project involved learning new content and securing computer time, while working around standardized testing and other school activities.

*Post-PBL interviews.* “I felt good about the whole process. I feel confident in what I did, and in how the students performed.” Kelly’s students created quality work products and she enjoyed “stepping back.” Support from colleagues was also essential in her belief that the PBL was successful. Two areas in which Kelly thought she needed to improve were creativity and the flow between content and the PBL. She said that she lacked the “creative juices” to create her own PBL unit, though she was comfortable with teaching PBL. The PBL was also “choppy,” she mentioned, describing how she separated the content and project. Despite these difficulties, Kelly felt that she was constantly evolving as a teacher—“always looking for new ways to be a better teacher.” This trait, Kelly explained, helped her experience success with the PBL project.
Observations. I observed two different classes of students that were at the same point in the project: an advanced group and a heterogeneous group. During the advanced class, Kelly and I mostly worked with students on project-specific questions. Students stayed on task and collaborated. At one point, Kelly led a group through the process of using a piece of basalt rock to estimate the cost of a large basalt boulder. During the heterogeneous class, Kelly and I spent most of our time helping students collaborate and stay on task. Kelly asked me to sit next to a group that was struggling. She and I assisted them with holding each other accountable and finding appropriate tasks. Despite the differences between these classes, Kelly mentioned in a post-PBL interview that some of her heterogeneous groups performed better than some of her advanced groups.

Within-case themes. I recognized three themes within Kelly’s case study: a) comfort with advanced students, b) getting them where she wants them to be, and c) the recovering perfectionist. Students in Kelly’s advanced class were often intimidating to her. She believed that the students judged her harshly, if she was unable to answer their questions. Kelly grew more comfortable with teaching advanced students, saying to her students, “I’m learning with you guys. That’s a great quality to have—to be an active learner.” She attributed her discomfort with teaching advanced students to a lack of experience with them in her pre-teaching experiences. When it came to struggling students, Kelly was torn on her ability to assist them. She explained, “A good teacher usually helps students learn, but sometimes, no matter what we do, we always have . . . I have some kids that I just can’t get to where I want them to be.” Though she had trouble with these students, Kelly had a process of helping these students reach their potentials. In the final theme, the recovering perfectionist, Kelly described her perfectionism as
detrimental to her teaching. She is continuously learning to be more flexible and “let things go.” PBL was a useful tool for her, because—as her career has progressed—she is becoming a facilitator rather than a “giver-outer” of information.

**Cross-case themes**

Categories drawn from coding interview and observation data were used to develop six cross-case themes. The cross-case themes present in these data were: (a) insecurities and inconsistencies with teaching skills outside of the science content, (b) altered grading, (c) the responsibility of failure, (d) changing the PBL project, (e) confidence within collaboration, and (f) multitasking facilitators.

_Iinsecurities and inconsistencies with teaching skills outside of the science content._ Teachers within this study had difficulties with teaching collaboration and language arts skills. Student groups that struggled with collaboration stuck out in each teacher’s mind. Despite experiencing success with most groups and feeling confident in their abilities to teach collaboration, the teachers expressed frustrations with the few groups that were unable to create a quality work product together. All of the teachers, except for Peggy, also had difficulties with finding the time to teach language arts skills. Marcy, Al, and Kelly believed that they would have more well-written student proposals with revision time than they did without revision time. Al had time to help some students revise their work and noted that it improved their proposals, Marcy was unsure about how to approach revision, and Kelly thought that she should have included student revision into the project plan.
Altered grading. Each of the case study teachers changed students’ grades based on individual effort and output. Kelly and Marcy intended to grade groups as a whole, but varied student effort made them uncomfortable with collective grading. Kelly and Al assigned specific portions of the PBL to students who were lacking effort and based their individual grade on their completion of those portions. Al was apprehensive about group grading throughout the PBL process, saying, “They didn’t learn anything, so they don’t earn anything.” Peggy created a group evaluation sheet in order to assess student effort. The evaluations and her observations determined the amount of points she added or subtracted from individual student grades, because of their effort.

The responsibility of failure. All of the case study teachers believed that failure was the students’ responsibility and was linked to effort. Kelly agreed with this belief in the focus group meeting, while the other case study teachers expressly stated it. Al explained that, “for a kid to fail, they didn’t try.” Al and Marcy described situations in which students decided not to participate in class activities, thus having negative results on their grades and relationships with other students. Marcy mentioned that students in her class who fail are making a “personal choice.” Peggy expressed her feelings about struggling students, saying, “When you feel you’ve given your all and you still have someone fail, it’s disappointing, but I did what I could do.” As long as she put forth her best effort, she believed that students fail because of extraneous reasons (i.e. lack parental involvement). All of the teachers described processes that they used to address struggling students. Kelly, for example, explained that she “stepped in” to help some groups quicker than others—based on their prior experiences with failure. She wanted students to put forth effort in their learning, but did not “want them to feel like they failed.” The other
teachers also described working with students one-on-one in order to overcome their motivation and learning difficulties.

Changing the PBL project. All of the case study teachers adjusted the PBL project and wondered whether they were “doing the PBL right.” Al and Kelly had moments in which they had to “pause” the project and reteach content. They also made the cost portion of the project extra credit, because students were unable to find the costs for some rocks. Marcy and Peggy retaught concepts, but did not mention “pausing” the project. Marcy changed the rubric into a question checklist, which had mixed results. “Half of the groups did well, grasped the idea, and ran with it. Half of the groups just followed the checklist and that was it.” Peggy started the PBL process unsure as to whether she would perform the PBL with all of her classes, entertaining the idea of a “scaled down” version for all but her advanced class. After some reflection time, Peggy decided to try the PBL with all of her classes and was pleased with the results. As long as the outcome of the PBL met their expectations, the case study teachers thought that there was no “right way to do PBL.” Peggy’s comment on the “right way to do PBL” summarized the thoughts of her colleagues: “It’s just about the final outcome and you’re taking those baby steps to get there. As long as we get there, I guess there is no right way.”

Confidence within collaboration. Collaboration was a source of confidence for three of the four participants. Al, Kelly, and Peggy had other teachers in their buildings—both in and out of this study—attempting PBL. Al and Kelly taught at the same school, and Peggy had a rock content expert and a gifted education coordinator with whom she worked together. Marcy was “on an island” as far as her PBL implementation, which elicited frustration and uncertainty from her. Though she was uncomfortable with being
the sole teacher in her building completing the PBL, she said that being a part of our
group made her more confident. All of the case study teachers described my value as a
collaborative resource within the PBL process. I was candid with my PBL experiences
and was continuously available for them to express their concerns and ask questions.

*Multitasking facilitators.* All of the case study teachers were confident in their ability
to multitask. They reported, and I observed them, handling technology issues, student
questions, classroom disruptions, and group meetings. Kelly, Marcy, and Peggy also
described their role as a facilitator. Kelly explained, “Guiding them through research and
their learning about different types of rocks is important. I’m not saying standing up in
front of class and pouring out information, but finding activities in which we learn
together.” Marcy enjoyed “stepping back” and was pleased with her students’ abilities to
question and support each other. Peggy explained that PBL reinforced her belief in
facilitation and shared a horror story from her middle school experience as a student.

**Research Question Two: Cross-Case Themes, Individual Experiences, and the
Connection between PBL and Self and Collective Efficacy**

In order to address my second research question, I examined further the cross-case
themes and individual teacher experiences—seeking a connection between PBL
implementation and efficacy. I also compared individual teacher experiences and
efficacies, based on STEBI results. The following connections/comparisons are
discussed: (a) student success and self-efficacy, (b) negative group interactions and
perseverance, (c) the importance of revision, (d) altered grading was common between
case study and non-case study participants, (e) accurately realizing student responsibility,
(f) changes in the PBL may indicate changes in self-efficacy, (g) PBL reinforces facilitation, (h) collective efficacy within the case-study group.

Student success and self-efficacy

Student success led teachers to believe that they could continue to teach PBL. Peggy, Al, and Kelly were excited about their students’ work products and cited them as a reason to complete another PBL. Students that typically struggled were excelling. As Peggy described, her special education students produced more and higher-quality work than usual. She attributed this to her grouping of students with disabilities among their non-disabled peers, allowing her and the intervention specialist to provide instruction that was more efficient. Kelly explained that groups in her “normal” class had better projects than some of her advanced student groups. Al, Kelly, and Peggy were positive about their abilities, when considering their students’ work.

Negative group interactions and perseverance

Each of the case study teachers within this study struggled with group dynamics and three of the four teachers struggled with teaching language arts. Despite having groups that were unsuccessful, the teachers in this study persevered and were confident about their abilities to teach collaboration to some students. They told stories in the post-STEBI interviews about groups that failed to work together and students who failed to contribute to groups. The case study teachers described some insecurity about teaching collaboration skills. Al prevented some students from working together, Kelly had
individual students who lacked effort, Peggy and Marcy had students who completed the majority of the project on their own.

The effort that the case study teachers put forth, however, may have been an indication of high self-efficacy. As Bandura (1977, 1993, 1997, 2007) stated, people with high self-efficacy are more likely to put forth effort than people with low self-efficacy. Three of the four case study teachers experienced an increase in STEBI score from pre- to post-PBL and completed the PBL project. Though his STEBI score decreased, Al completed the PBL with all of his students. The case study teachers attempted to help their student groups succeed, even when they had moments of doubt.

Kelly described herself as “somewhere in the middle” of teaching collaborative skills, though she was able to explain techniques that helped her motivate students to participate. As Peggy stated, “When you feel you’ve given your all and you still have someone fail, it’s disappointing, but I did what I could do.” Marcy explained that, if a few groups were struggling, she would adjust—rather than give up on—the PBL project. All of the teachers described failure as the responsibility of the students. As long as the participants put forth their best effort to make learning accessible to the students, they believed that it was up to the students to rise to the task.

Despite difficulties with teaching collaboration skills, teachers in this study recognized the importance of teaching these skills. They would continue to teach collaboration skills, because it was best for their students. The teachers’ ability to persevere, in spite of some groups’ struggles, was an example of self-efficacious behavior and is an indication that their students will learn to persevere as well (Bandura, 1993).
The importance of revision

Peggy was the lone participant who built in time for revision and it paid dividends for her students. She saw their writing improve throughout the project and believed that revision time influenced student assessment scores. This was an indication of her efficacy with teaching language arts skills prior to the PBL, because she was comfortable with assisting them in their writing. As mentioned above, student successes may have positively influenced her efficacy; her STEBI score was the highest both pre- and post-PBL. The revision process improved her students’ work, which made her likely to repeat the PBL process. Her confidence in her ability to teach language arts skills led to better products, which may have positively influenced her efficacy.

Altered grading was common between case study and non-case study participants

All of the teachers in this study changed students’ grades based on individual work products and effort. Rather than work through group issues and put the responsibility on the students, for perennially struggling groups, some of the teachers took over the project—assigning individual parts to each student and determining group goals. Marcy, Al, and Kelly broke the project up for groups in which students were unwilling to do their part. Peggy used a peer evaluation to adjust student grades at the end of the project.

Their discomfort with the “all for one” aspect of PBL is understandable. The case study teachers all discussed fairness in their grading—giving kids the grade that they earned through effort. The non-case study focus group members also described altering student grades based on effort and work output. All of the case study teachers were comfortable with students in functional groups earning the same grade, but groups with
unwilling students made the teachers balk at collective grading. The concepts of fairness and explaining their grades to parents were present in the data.

I experienced the same apprehension, when I first started PBL as well. I am, presently, comfortable with having collective group grades and explaining them to parents, because I am confident in my ability to assess and assist with group issues. I am also willing, as discussed in Chapter V, to remove students—who are uncooperative—from a group and hold them accountable to the same standards. Despite my confidence in collective grading, I have experienced moments when I am unsure students have earned the same grade as their group. Finding the time to keep track of every group’s progress can be daunting. I also find it difficult to assess students “at their level.” Some students come in to a project with higher work ethics and academic success than their peers. Much like Peggy and her students with special needs, some of my students may not do their “fair share,” but they exceed their normal effort and output. My experiences helped me empathize with the pressures of fairness and parental involvement that influenced case study and non-case study teachers’ attitudes toward collective grading.

With some adjustments in timing and purpose, I believe that Peggy’s peer evaluation that she used to determine individual grades could help students develop collaboration skills. Making the peer evaluation part of the learning process, rather than a final evaluation, would have boosted her students’ communication skills and effort. The students would have been able to recognize and discuss group strengths and struggles, bringing light to group issues that needed to be resolved. Peggy can use her peer evaluation during the next PBL in order to understand where students need her assistance. 
most. Doing the peer evaluation only at the end of the project made it evaluative rather than formative.

**Accurately realizing student responsibility**

The participant teachers took responsibility for student learning and believed that they were capable of performing necessary behaviors that led to student learning. While understanding their roles in student learning, they also recognized that students were responsible for their effort and learning (see the Responsibility of Failure theme in Chapter V). People could misconstrue this as a lack of self-efficacy—saying that the teachers were blaming students for their struggles with learning. I viewed it, however, as efficacious behavior. The teachers in this study recognized and felt confident in their abilities to help students learn. When a student failed to reciprocate their efforts, they put the responsibility on the student. If students were putting forth effort, the teachers in this study were able to help them learn. If the students lacked effort, the teachers attempted to help them in multiple ways.

Where teachers have to be careful in ascribing blame to student effort is in the accuracy of their measurement of effort—both the student’s and their own. Teachers in this study exhibited self-efficacy when they balanced their responsibility to teach with the students’ responsibility to learn. For example, when Kelly attempted to help a struggling group with multiple meetings, supporting group leaders, and holding students accountable, she displayed a balance of her effort and the students’ efforts. As Peggy experienced while her students with special needs worked in heterogeneous groups, high
effort looks different for each student. Teachers that accurately assess student effort can push students to achieve their potentials, as Peggy did with her students.

**Changes in the PBL may indicate changes in self-efficacy**

The teachers in this study tweaked the PBL unit in order to fit their students’ learning needs and their teaching philosophies. Some changes may indicate increased self-efficacy, while others may indicate a decrease in self-efficacy. All of the teachers described re-teaching content in order to ensure student mastery. Al, for example, recognized that his students were struggling with the concepts of weathering and erosion. He created a lesson based on these concepts that students could apply to the PBL project. Though his overall STEBI results decreased, my observations of this lesson and his comments indicated that it was a moment of heightened self-efficacy for Al.

Marcy’s adjustment to the PBL rubric, while well intentioned, was an indication of decreased self-efficacy. Toward the beginning of the PBL, Marcy changed the rubric into a series of questions. I detailed her frustrations with students’ reactions to this change in Chapter V. Marcy said that she changed the rubric, because she was uncomfortable with her ability to guide students through the project. As she described, she was more teacher-centered at this point in her career and she was unsure about her students’ abilities to handle the freedom of this PBL unit. Changing the rubric into specific questions reduced the PBL to a teacher-centered project, which was her comfort zone. The rubric was an example of Marcy’s struggle with her ability to teach students the skills that they needed to accomplish the PBL in a more open environment.
Peggy started the pre-PBL interviews indicating that she was only performing the PBL with her advanced classes. As the pre-PBL interview process went on, she determined that she would implement PBL with all of her classes—indicating an increase in self-efficacy. Through her research about PBL, colleague support, and our conversations, she became comfortable with her ability to implement PBL with all of her classes. Performing the PBL, as Peggy reported, benefited her students’ academic knowledge and skill development. Her increase in self-efficacy led to student learning, which mirrors Bandura’s (1993) research on teacher efficacy and academic achievement.

**PBL reinforces facilitation**

The PBL unit reinforced most of the case study teachers’ ability to facilitate learning. PBL inherently provides opportunities for teachers to facilitate, rather than direct, learning. As teachers experienced PBL, they provided students with opportunities to take charge of their learning and focused on guiding students through the process. Marcy explained that she enjoyed watching students handle freedom responsibly. Peggy and Kelly described their roles as a facilitator as a normal part of their classroom. All of the teachers experienced different levels of success while working with student groups on academic, research, technology, and collaboration issues.

Al may be an exception to this finding, because of his increase in undecided responses on the STEBI. For example, on STEBI statement twenty-four, “When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better,” he changed his response from disagree to undecided. I observed Al facilitating effectively and he used leading questions with students, rather
than giving them an unearned answer for all of their questions. His STEBI response, however, casts some doubt on his self-efficacy in facilitating the learning process.

**Collective efficacy within the case-study group**

The teachers within this study had high collective efficacy at the end of the PBL project. Uniting with teachers from schools outside of their own provided support for each teacher. In addition to each other, the participants thought that I was part of the support structure within this PBL implementation. As described in Chapter V, the teachers were comfortable with implementing PBL because they were able to contact each other and me in order to work through difficulties. Their communication with each other is an indication of collective efficacy, because they believed that other teachers in the group were competent enough to answer their questions. Marcy experienced the most apprehension toward PBL, because she was the lone teacher in her building attempting it. Though she was alone in her school, the sense of high collective efficacy from our group allowed Marcy to experience some success, overcoming “being on an island.”

All of the teachers indicated that they were able to teach PBL and would in the future, but creating a PBL would require a team effort. Their collective efficacy in the area of creating a PBL was higher than their individual self-efficacies, because they believed in the group’s ability to create a PBL. All participants described how they would like to work with other teachers in order to create a PBL. Some of the participants explained that they would like to design cross-curricular PBL units with teachers in other subject-areas. A self-described lack of creativity of the participants and inexperience with the teaching method may explain the apprehension toward making their own PBL unit. Their
willingness to work on a PBL together, however, is an indication of high collective efficacy.

**Research Questions Summary**

Being an advocate of PBL, I would like to have written about the significant positive affect that it had on teacher efficacy during this study. The truth, however, is that I cannot assert efficacy changes were due solely to PBL or that the case study participants had significant changes in their efficacies during this study. Although the overall self-efficacies of the teachers did not change dramatically (see Table 5.2 and 5.4), I believe that interview and observation data show that each teacher experienced moments of changing self-efficacy—as described above. Each teacher experienced PBL differently, yet there were connections between their experiences—as seen in the within- and cross-case themes. Though there were commonalities in experiences, the PBL project did not always look the same. Each teacher changed the PBL in some way to accommodate either his or her teaching style or the needs of their students. Interview and observation data also indicated an increase in collective efficacy. Each teacher was willing to reach out to the group for assistance and work on another PBL together—both indications of collective efficacy.
Implications for Future Research

Limitations of this study

There are aspects of PBL and efficacy research that this case was unable to address. Continued and expanded research would provide further insight into the connection between PBL and efficacy. First, the teachers in this study had a range of five to eleven years of experience. A similar study involving teachers with twenty or more years of experience would allow for a comparison of these two demographic groups and a different perspective on the change process. First- or second-year teachers could provide a different perspective as well.

Second, this study took place in a suburban central Ohio school district. Forty-five states within the United States have adopted the Common Core, and PBL is a suggested method of instruction within it (Common Core State Standards Initiative, 2010; NRC, 2012). Performing this type of study in other regions of the United States, or in rural and urban districts, could bring drastically different results—considering the range of cultural and socioeconomic differences in the United States. Studies in other areas could also provide support for the data analysis and conclusions in this study.

Third, the participants in this study were science teachers. Studies that focus on the effect that implementing PBL has on efficacy in other subject areas could create a link between teachers’ experiences. A meta-analysis of PBL research from all subject areas would bring out the universal aspects of implementing PBL and its effects on teacher efficacy.
Fourth, this study focused on teachers. Though I discussed student reactions and behavior, it was in relation to teachers’ experiences and efficacies. A phenomenological case study of students involved in PBL would provide insight into its effects on their efficacy, ability to collaborate, enjoyment of learning, and resiliency.

Fifth, this study connected efficacy to the implementation of PBL only. Teachers are constantly learning new ways with which to reach their students. Comparing the impact that implementing PBL had on teacher efficacy with the impact that implementing other teaching methods have on teacher efficacy could reveal the nature of implementing any new teaching method and its impact on efficacy.

Finally, my proximity to the case study participants created the potential for bias. The case study participants were colleagues with whom I have had professional relationships for many years. There was the possibility that they said what they thought I wanted them to say, rather than their actual thoughts or beliefs. I never thought, and do not think, that this was the case. I believe that the case study participants were more likely to be sincere in their responses, because of the trust in our relationships. I must acknowledge my proximity as an opportunity for bias, however, because it may have blinded me to moments when participants stated what they thought I wanted to hear. My relationships with them also have the potential to bias my view of their efficacies and development of themes. I am interested in whether the same themes are present in a study with a group of teachers who are not colleagues.
Student and teacher grit

There is recent research on student grit, which has connections to teacher self and collective efficacies (see Fink, 2013; Hoerr, 2012). Grit involves students being able to overcome difficulties in order to succeed and it relies on a growth, rather than fixed, mentality. Students with grit focus on how they have improved and what they have learned, instead of attributing their accomplishments or failures to innate ability (Fink, 2013; Hoerr, 2012). This mirrors Bandura’s (1993) research on student learning and its connection to efficacy. Within this study, teachers showed grit in their ability to continue PBL, despite difficulties in the process. This research study begins to shed light on the connection between teacher grit—that is a product of efficacy—and student grit. Based on my analysis and assessment of this study and other efficacy research, I assume that highly efficacious teachers enhance student grit. Researchers interested in student grit should explore this connection to teacher efficacy.

False efficacy

A question that was beyond the scope of this study consistently permeated my mind: Is there such a thing as false efficacy—when people perceive themselves as being competent at performing a behavior, but they are misguided or not seeing their true selves? Some of the teachers in this study would claim that they were confident in their abilities, but I failed to see that comfort in any other data. Do they know that they are not able to perform this behavior and pretend that they can perform? Do they pretend that they are competent, because they are afraid of appearing confused, insecure, or incompetent? Do they believe that they can perform a behavior, even though they are
unable to perform it? When I picture false efficacy, I see internet videos, in which someone is trying a stunt—like jumping from one rooftop to another—and they fail. I wonder if they had a realization that they could not do the stunt right before they jump. Does that doubt—lack of efficacy—cause them to fall or did they lack the ability, meaning they would have fallen no matter how much efficacy they had? Is that actually high efficacy, because they were willing to try a difficult task? Future research could explore the possible existence of false efficacy within teachers and its implications on their abilities and outcomes.

Implications on Educational Practices

Implications for in-service and pre-service teachers

Educators at any level can benefit from the findings within this study. As described in Chapter I, the cases provide detailed descriptions of each teacher’s experience with implementing a new teaching method. Understanding the triumphs and struggles of the participant teachers will help new and veteran teachers as they develop their craft. These cases demonstrate that change is tough, but worth the hardship. Pre-service teachers can vicariously experience the implementation of a teaching method and discuss each case, including how they would have handled situations in which the participant teachers were involved.

PBL and other inquiry-based methods are mental shifts within the field of education and individual teachers’ minds. As seen in this study, some teachers had to adjust their concepts of teaching and learning in order to implement PBL, while others believed that
PBL was a natural fit for them. In-service teachers, who are planning to use PBL, can use the cases in this study as a “what to expect” guidebook. The Common Core State Standards call for multiple subject areas to use PBL in order to address 21st Century skills (Achieve, 2012; Common Core State Standards Initiative, 2010). Following this study, middle school mathematics teachers, from the district in which this study took place, started using PBL in conjunction with the Common Core. As Kotter and Schlesinger (1979) noted, education is a remedy for resistance to change. The more teachers understand PBL, the more likely they will be to buy-in to the tenets of PBL. Through reading these cases, teachers will realize the goals of PBL and recognize the effective implementation, benefits, and complexities of PBL. They will also be able to avoid the mistakes that the teachers within this study made.

The “Altered Grading” section of Chapter V opens up the conversation about grading practices. How much should teachers assess effort as a part of students’ grades? Is it fair to give a group grade, rather than individual grades? How do teachers objectively assess collaboration? How do we foster collaboration in the classroom and uphold individual accountability? These questions are not novel to PBL, but deserve further consideration in 21st Century learning environments—in which collaboration is a focal point.

**Implications for administrators**

Building administrators and curriculum directors can pull effective practices from this study. This study was an example of the power of collective efficacy and human capital. Three of the four teachers believed in their ability to complete the PBL, because of the power of the group and other teachers in their buildings. Collaboration and support
positively affected the teachers’ individual and collective efficacies in implementing PBL. Marcy, who described herself as “on an island,” believed that the PBL would be more difficult and stressful for her. Support from people within the study, however, made Marcy more comfortable with the process. These findings are a call to administrators at the building and district levels to provide collegial support within teaching method and curriculum implementation.

District and building administrators can also use the data from this study to understand the pressures of teachers implementing new teaching methods, within a high-stakes testing environment. Three of the four case study teachers in this study cited content knowledge acquisition as their primary goal within PBL. Although teaching content is important, PBL and 21st Century skills—found in the Common Core—focus on more than knowledge acquisition. Teachers implementing PBL, including the case study participants in this study, teach students skills outside of their content area (i.e. collaboration and technology). Spending class time on skills outside of content knowledge is a challenge in high-stakes testing environments. Marcy described her insecurities with teacher evaluation and standardized testing while implementing a new method. The standardized tests that her students had to take, and upon which she would be partially evaluated, made her hesitant to change her approach to teaching. She wondered about the benefits of teaching skills outside of the content, when her students would be judged upon their content knowledge. Administrators should be cognizant of the struggle teachers have between implementing new pedagogy and performing on statewide exams.
Summary

This was phenomenological case study involving four middle school science teachers implementing PBL. The teachers participated in pre- and post-implementation interviews, observations during the PBL unit, and a post-implementation focus group interview. I also collected artifacts, used member-checking, and discussed findings with a focus group outside of the study and my dissertation committee in order to triangulate my data analysis—making it trustworthy.

Within Chapter IV, I described the experiences of each participant teacher and their thoughts on PBL prior to, and after, implementation. Within-case themes and my perception of each teacher were also discussed. In Chapter V, I explained six cross-case themes that were present in the data. The themes were: (a) insecurities and inconsistencies with skills outside of the science content, (b) altered grading, (c) the responsibility of failure, (d) changing the PBL project: Is there a right way, (e) confidence within collaboration, and (f) multitasking facilitators. I also described my experiences with the cross-case themes and compared STEBI data from participants and non-participants.

Within Chapter VI, I restated my research questions and methodology, explained my conclusions, connected findings to efficacy and PBL literature, and presented implications on future research and educational practices within this chapter. The STEBI data showed that Kelly, Marcy, and Peggy experienced an increase in their efficacy scores, while Al experienced a decrease in his efficacy score. Each teacher, however, questioned their abilities and had successes during this study. Collective efficacy was high at the end of the study. The teachers wanted to complete more PBL units with each
other and with people outside of this study. They trusted in each other’s ability to create a PBL lesson as a group. Future research should attempt to connect learning new methods to efficacy in all educational settings and help educators promote inquiry learning. Lessons learned from this study have the potential to benefit any classroom teacher or administrator going through an instructional change process in the current high-stakes testing environment.
References


APPENDIX A

PBL UNIT RUBRIC FOR THIS STUDY
**PBL Unit Rubric for this Study**

<table>
<thead>
<tr>
<th>Proposal Information</th>
<th>Mastery</th>
<th>Almost There</th>
<th>Not Quite</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rock Characteristics</strong></td>
<td>- the name and type of rock (igneous, sedimentary, or metamorphic) - an explanation of the characteristics specific to that type of rock - the minerals or other materials that make up the rock</td>
<td>Two of the three items listed in this category</td>
<td>One of the three items listed in this category</td>
</tr>
<tr>
<td><strong>Rock Formation and the Rock Cycle</strong></td>
<td>- how the rock was formed - a description of two paths in the rock cycle through which the rock could have been created</td>
<td>- how the rock was formed - one path through the rock cycle</td>
<td>The team’s proposal includes one of the two items listed in this category</td>
</tr>
<tr>
<td><strong>Mining and Common Uses</strong></td>
<td>- where the rock is found - a detailed explanation of how the rock is mined - common uses for the rock and the minerals that make it</td>
<td>Two of the three items listed in this category</td>
<td>One of the three items listed in this category</td>
</tr>
<tr>
<td><strong>Justification</strong></td>
<td>- a detailed explanation about why the rock was chosen, giving multiple reasons why it is the best rock to use for a statue in our region - multiple advantages and disadvantages of using this type of rock in the statue</td>
<td>- a brief explanation about why each rock was chosen - some advantages and disadvantages of using this type of rock in the statue</td>
<td>The team’s proposal includes one of the two items listed in this category</td>
</tr>
<tr>
<td><strong>Economics</strong></td>
<td>- from where the rock can be purchased - how much of the rock is needed to complete the statue - how much the rock will cost to purchase and ship to our school</td>
<td>Two of the three items listed in this category</td>
<td>One of the three items listed in this category</td>
</tr>
<tr>
<td><strong>Scale Drawing</strong></td>
<td>- a scale drawing of the statue - the ratio of the scale is included (example: 1 inch = 2 feet or 1 centimeter = 1 meter) - height and width dimensions labeled on the drawing</td>
<td>Two of the three items listed in this category</td>
<td>One of the three items listed in this category</td>
</tr>
</tbody>
</table>
APPENDIX B

CASE STUDY PARTICIPANT CONSENT FORM
Case Study Participant Consent Form

Teacher Efficacy Perceptions during the Implementation of Project-Based Learning

A. PURPOSE AND BACKGROUND

The objective of my research is to describe the experiences of middle school science teachers who are implementing project-based learning and determine the effect of implementing project-based learning (PBL) on teacher efficacy. I am asking you to participate because you are a middle school science teacher who is implementing PBL.

I will use the information to analyze teacher efficacy and the implementation of teaching and learning methods in middle school science classrooms. My results will be presented to a focus group of ten middle school science teachers, in my dissertation for the Ashland University Doctoral Program, and in the oral defense of my dissertation. In addition, results may be used for presentations in other professional settings and published in professional journals.

The consent form, which you are signing, will last from the date of your signature through August of 2013.

B. PROCEDURES

If you agree to be in the study, the following will occur:

1. You will participate in six 20-minute interviews that focus on the implementation of PBL and teacher efficacy.

2. I will observe your classroom twice as you are teaching a portion of a PBL unit.

3. You will participate in a round table discussion with all case study participants at the end of the school year.

4. You will fill out a brief demographic sheet.

5. You will share lesson plans, activities, and notes that pertain to the implementation of PBL.

6. You will complete the Science Teacher Efficacy Belief Instrument twice. Once at the beginning of the study, and once at the end.

C. RISKS/DISCOMFORTS

There are no immediate or long-term risks/discomforts
D. BENEFITS

The information that you provide will inform science teachers, administrators, and educational researchers about the implementation of teaching methods and strategies in the classroom. Students will benefit from the information that you provide, because educational stakeholders will gain a more thorough understanding of the implementation process.

E. COSTS

There will be no costs to you as a result of taking part in this study.

F. PAYMENT

There will be no payment made to you as a result of taking part in this study.

G. QUESTIONS

You have talked to Chad Clark about this study and have had your questions answered. If you have further questions, you may e-mail him or call him.

If you have any comments or concerns about participation in this study, you should first talk with the researcher. If for some reason you do not wish to do this, you may contact his dissertation advisor, Dr. Carla Edlefson. The Human Subjects Review Board, which is concerned with the protection of volunteers in research projects, may also be contacted. You may reach the board office between 8:00 a.m. and 5:00 p.m., Monday through Friday, by calling (419) 207-6198 or writing the Dean of the Graduate School, 100 Founders Hall, Ashland University, Ashland, Ohio 44805.

H. CONSENT

You will be given a copy of this consent form to keep. PARTICIPATION IN RESEARCH IS VOLUNTARY. You are free to decline to be in this study, or to withdraw from it at any point. Your decision as to whether or not to participate in this study will have no adverse consequences.

If you agree to participate, you should sign below.

_________________________________________  ___________________________________________
Date                                               Signature of Study Participant

_________________________________________  ___________________________________________
Date                                               Signature of Person Obtaining Consent
APPENDIX C

WRITTEN EXPLANATION PRIOR TO THE STEBI SURVEY
Written Explanation prior to the STEBI Survey

You are about to complete the Science Teacher Efficacy Beliefs Instrument, which is a part of Chad Clark’s dissertation research. PARTICIPATION IN RESEARCH IS VOLUNTARY. You are free to decline this survey. Your decision as to whether or not to participate in this survey will have no adverse consequences.

If you have any comments or concerns about participation in this survey, you should first talk to Chad Clark. If for some reason you do not wish to talk to Chad Clark, you may contact his dissertation advisor, Dr. Carla Edlefson. The Human Subjects Review Board, which is concerned with the protection of volunteers in research projects, may also be contacted. You may reach the board office between 8:00 a.m. and 5:00 p.m., Monday through Friday, by calling (419) 207-6198 or writing the Dean of the Graduate School, 100 Founders Hall, Ashland University, Ashland, Ohio 44805.
APPENDIX D

SCIENCE TEACHING EFFICACY BELIEF INSTRUMENT
### Science Teaching Efficacy Belief Instrument

Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate letters to the right of each statement.

**SA = Strongly Agree**

**A = Agree**

**UN = Uncertain**

**D = Disagree**

**SD = Strongly Disagree**

<p>| | | | | | |</p>
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<tbody>
<tr>
<td>1</td>
<td>When a student does better than usual in science, it is often because the teacher exerted a little extra effort.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>2</td>
<td>I am continually finding better ways to teach science.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>Even when I try very hard, I don’t teach science well.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
<td>When the science grades of students improve, it is most often due to their teacher having found a more effective teaching approach.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>I know the steps necessary to teach science concepts effectively.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>6</td>
<td>I am not very effective in monitoring science experiments.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>7</td>
<td>If students are underachieving in science, it is most likely due to ineffective science teaching.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>8</td>
<td>I generally teach science ineffectively.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>9</td>
<td>The inadequacy of a student’s science background can be overcome by good teaching.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>10</td>
<td>The low science achievement of some students cannot generally be blamed on their teachers.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>11</td>
<td>When a low achieving child progresses in science, it is usually due to extra attention given by the teacher.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>12</td>
<td>I understand science concepts well enough to be effective in teaching middle school science.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>13</td>
<td>Increased effort in science teaching produces little change in some students’ science achievement.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>14</td>
<td>The teacher is generally responsible for the achievement of students in science.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>15</td>
<td>Students’ achievement in science is directly related to their teacher’s effectiveness in science teaching.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
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</tr>
<tr>
<td>16.</td>
<td>If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child’s teacher.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>17.</td>
<td>I find it difficult to explain to students why science experiments work.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>18.</td>
<td>I am typically able to answer students’ science questions.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>19.</td>
<td>I wonder if I have the necessary skills to teach science.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>20.</td>
<td>Effectiveness in science teaching has little influence on the achievement of students with low motivation.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>21.</td>
<td>Given a choice, I would not invite the principal to evaluate my science teaching.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>22.</td>
<td>When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>23.</td>
<td>When teaching science, I usually welcome student questions.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>24.</td>
<td>I don’t know what to do to turn students on to science.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
<tr>
<td>25.</td>
<td>Even teachers with good science teaching abilities cannot help some kids learn science.</td>
<td>SA</td>
<td>A</td>
<td>UN</td>
<td>D</td>
</tr>
</tbody>
</table>

APPENDIX E

PRE-PBL AND POST-PBL INTERVIEW PROTOCOLS
Pre-PBL and Post-PBL Interview Protocols

Pre-PBL questions

What are your initial thoughts on Project-Based Learning (PBL)?

How do you plan to implement PBL into your classroom?

What do you think are the benefits and drawbacks of PBL?

How have you prepared to teach a PBL unit?

How did the district help you prepare for teaching a PBL unit?

Are you adequately prepared to teach a PBL unit?

How confident do you feel in your ability to create or teach a PBL unit?

How confident are you in your students’ abilities to learn during a PBL unit?

What are your thoughts on your STEBI responses?

Post-PBL questions

Now that you have taught a PBL unit, what are your reflections on the process?

How do you think the PBL unit affected student learning?

How do you think the PBL unit affected students’ interests in science?

Describe your struggles and triumphs during the PBL unit.

Describe your students’ struggles and triumphs during the PBL unit.

How confident are you in your ability to create or teach a PBL unit?

How confident are you in your students’ abilities to learn during a PBL unit?

What are the benefits and drawbacks of PBL?

After some reflection time, were you adequately prepared to teach a PBL unit?

Since the last time we talked, has there been anything that has come to mind about our discussion or the PBL unit?

Now that you have completed the STEBI after the PBL, how do you feel about your responses? Were there any that you think change dramatically?