THE ROLE OF THE SOURCES OF SELF- AND COLLECTIVE EFFICACY IN PROJECT-BASED LEARNING IMPLEMENTATION

By

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ABSTRACT

Project-based (PBL) learning has been found to improve student achievement, engagement, and interpersonal and intrapersonal skills; however, it is not widely implemented in K-12 schools in the United States. Prior research has established several barriers and challenges to implementing PBL in K-12 schools including challenges related to teacher beliefs, teaching practices, and school contexts. This multiple case study focuses on teacher beliefs and school contexts by seeking to understand what role the sources of self- and collective efficacy play in teachers' adoption of PBL into their classroom and how the sources of self- and collective efficacy and their role in teachers' adoption of PBL differ across three different secondary schools. Results of this study indicate that clear definitions of PBL and supportive structures such as school-wide professional learning, professional learning communities, and peer observations are needed for teachers to experience self- and collective efficacy for PBL implementation. Furthermore, the role of positive affective states such as joy and trust may play a more significant role in the development of self- and collective efficacy than previously thought and that more opportunities for vicarious experiences through peer modeling may be especially important for PBL efficacy. Implications for further research include additional research that focuses on the role of these enabling conditions for school-wide PBL as well as more research that clarifies how the sources of collective efficacy are operationalized in K-12 schools implementing PBL.

To John, Teaghan, and Jay
for telling me I could do hard things.

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CHAPTER ONE: INTRODUCTION

Project-based learning (PBL) is an instructional practice in which students approach a driving question through sustained inquiry, collaborative learning, and the creation of an authentic product (Krajcik et al., 1994; Lenz & Larmer, 2020). Research indicates that the implementation of PBL in K-12 classrooms has the ability to improve student achievement (Halvorsen et al., 2012; Parker et al., 2013). Despite these documented positive effects for students, PBL and other similar student-centered practices like problem-based learning, service learning, and inquiry-based learning are not regularly implemented in K-12 classrooms (Seitsinger, 2005; Thacker et al., 2017).

If PBL has been shown to increase student achievement, why don't more schools implement it? There is a large body of research documenting barriers teachers report about implementing PBL. Time constraints, pressure from standardized tests, or administrative disinterest (Harris et al., 2015; Thacker et al., 2017) are reasons teachers struggle to implement PBL. In addition to these barriers, teachers report instructional challenges when implementing PBL such as difficulty shifting control to students, managing the ambiguity of projects, and scaffolding student needs (Grant & Hill, 2006; Hasni et al., 2016; Dunbar & Yadav, 2022). A social cognitive lens that addresses the role of environment, behavior, and cognition (Bandura, 1977) offers a motivational lens to understanding the influences on a teacher's decision to implement, or not implement PBL.

Specifically, prior research has suggested that teacher motivation to change practices is influenced, at least in part, by their sense of efficacy, their belief that they can create certain outcomes (Tschannen-Moran et al., 1998, Tschannen-Moran & McMaster, 2009). In addition to self-efficacy, social cognitive theory says that teachers are also motivated by the social context they find themselves in. Organizations and schools have a sense of *collective* efficacy which is the result of shared beliefs in collective power to achieve desired results (Bandura, 2000). Collective efficacy also has an impact on the motivation of teachers and their willingness to engage with a practice like PBL (Donohoo, 2018). To understand how self-efficacy and collective efficacy develop for teachers, one must consider the sources of teacher efficacy. Bandura (1977) established four sources of efficacy - mastery experiences, vicarious experiences, social persuasion, and affective states. Goddard and colleagues (2000) posited that these same sources also contribute to collective teacher efficacy. When seeking to understand

how implementation of PBL develops in a school, teacher efficacy and its sources may provide important insights that influence how leadership supports and sustains PBL implementation in K-12 schools.

This dissertation is organized as follows. In Chapter Two, I explore the relevant literature of PBL implementation, self- and collective efficacy, and prior studies that have researched the relationship between self- and collective efficacy and PBL implementation. Chapter Three details my methodological approach including my selection of cases for this study, data collection, data analysis, and my positionality. Chapter Four describes each case study by first describing the school context, then themes related to collective efficacy followed by themes related to self-efficacy, and concluding with challenges each case faces in regards to PBL implementation. In Chapter Five I outline four findings based on my interpretation of the cases and explore implications for both practice and research as well as limitations. Finally, in Chapter Six I share concluding remarks.

CHAPTER TWO: LITERATURE REVIEW

In this chapter I will provide important framing for this study by first reviewing relevant PBL research and then exploring social cognitive theory and prior research on the sources of self- and collective efficacy. In the first section of this review, I will provide a background and context for the current state of PBL research in terms of K-12 implementation. I will define PBL, explore prior research related to the benefits of PBL for students, and the challenges PBL presents for teachers. I will conclude this initial section by highlighting research on enabling conditions for successful PBL implementation. I will then define social cognitive theory and explore prior research about teacher self-efficacy and collective efficacy. This section will conclude by reviewing the limited research on efficacy and PBL.

Project-based Learning as a Promising Practice

Defining Project-based Learning

Project-based learning is an approach to classroom instruction that is anchored in student-centered learning pedagogies and stems from a constructivist view of learning. Constructivism posits that the learner is the meaning-maker and their understanding is developed through social interactions with peers as well as tools (Dewey, 1938; Vygotsky, 1978). Project-based learning provides a structure for students to interact with each other, as well as with content and resources, to develop students' understanding of disciplinary knowledge and processes. PBL usually takes place over several classes, employing critical thinking, problem-solving skills, collaboration, reflection, student choice, and student voice (Blumenfeld et al., 1991; Miller & Krajcik, 2019). For the purposes of this study, I will define PBL as an instructional practice in which students approach a phenomenon through a driving question, using sustained inquiry and collaborative learning, leading to the creation of an authentic product (Krajcik et al., 1994; Grossman et al., 2019). Furthermore, there are several high-quality elements of PBL implementation. These elements include authenticity, student voice and choice, public products, driving questions, opportunities for critique, revision, and reflection as well as high levels of student collaboration (Mergendoller, 2018).

Benefits of Project-based Learning

Prior PBL research has focused on its impact on student learning when compared to traditional pedagogical approaches. There is a large body of research that suggests that students who participate in PBL perform better on achievement tests and performance-based tasks than

their peers who receive direct instruction (Halvorsen et al., 2012; Parker et al., 2013). For example, Hernandez-Ramos and De La Paz (2009) found that student scores on state assessments and study-specific knowledge tests results were higher for the students who completed a cooperative, multimedia project-based learning history unit than those of students in history classrooms without a specific pedagogical approach. Similarly, Han and colleagues (2015) found that students who participated in STEM PBL increased their performance on a state-based mathematics exam. More recently, Schneider et al. (2022) reported that students who were engaged in a PBL high school science curriculum scored higher on a summative assessment than the control group. These studies suggest that students who are taught through PBL can do as well or better than students taught in more traditional methods.

Some studies have also indicated that this increase in achievement especially helps students from traditionally marginalized groups. For example, Halvorsen et al. (2012) found that second graders who learned civics and economics through a PBL unit demonstrated improvement on standards-based content and literacy assessments. Furthermore, the results suggested that student performance from low socioeconomic schools improved in ways that resulted in a narrowing of the achievement gap between low and high socioeconomic schools (Halvorsen et al., 2012). Parker et al. (2013) saw similar results for AP Government students who participated in a project-based course. The students in the PBL treatment group scored the same or better than students within a traditional instructional program regardless of whether they were new to AP coursework or not (Parker et al., 2013). In a related study, Saavedra et al. (2022) conducted a cluster randomized control study comparing student AP exams scores between treatment classes that used a PBL teaching approach and control groups that used traditional lecture-based methods in AP Environmental Studies classes and AP Government classes in 68 schools in five different school districts. The authors found that the PBL approach resulted in improved students' AP exam performance across both courses, within each course, and with students from both low- and high-income households. In a study conducted in Detroit Public Schools (91% African-American), Geier et al. (2008) found that students in the PBL classes scored 19% and 14% higher on successive state science achievement tests than other students. Furthermore, there seemed to be a decrease in the boy-girl achievement difference on the state science exam. Geier et al. (2008) argued that "project-based units appear to engage at-risk urban male learning, narrowing and closing the gender gap in achievement with their fellow peers" (p.

933). Thus, the potential of PBL to help narrow the achievement gap for minoritized students is promising.

In addition to increasing student achievement in content areas, some studies have also shown PBL to have a positive impact on student engagement and interpersonal and intrapersonal skills such as collaboration, communication, self-regulation, problem-solving, and reflection. Krajcik et al. (2023) saw that in a randomized control study conducted with 2,371 third grade students in 46 schools in Michigan, exposure to a multiple literacy PBL science intervention resulted in higher scores on standardized science achievement tests as well as positive effects on student collaboration and self-reflection. Importantly, this improvement was true for students across genders, race and ethnicity, income levels, and geographic areas of Michigan. In their 2019 research examining three schools in the southeastern United States that adopted Project-Based Learning (PBL), Culclasure and colleagues discovered that students attending PBL schools—where the majority of teachers employed PBL methods—surpassed their peers on the Deveraux Student Strengths Assessment (DESSA), a tool for screening social-emotional competencies. Students in the PBL schools showed higher composite scores with significantly higher scores in the areas of relationship skills and self-management. Students also self-reported that they felt that their exposure to PBL increased their ability to relate to people with different opinions and their confidence when presenting their ideas to others. MacMath et al., (2017) also found that teachers perceived that students were highly engaged in the PBL experience and developed collaborative skills as a result of being exposed to PBL. Magaji's (2021) examined the experiences of 52 grade eight British students participating in a science-based PBL and found a positive impact on collaborative learning skills, demonstrating that PBL can have positive impacts outside of the United States as well. Condliffe and colleagues's (2017) literature review of PBL also found that students' interpersonal and intrapersonal skills were improved via their exposure to PBL. These studies point to the role PBL can play in increasing student academic achievement as well as transversal skills such as collaboration, project-planning, and self-regulation.

Challenges to Project-based Learning

Despite this significant body of research on the positive impact of PBL on student achievement, PBL is not widely implemented in K-12 schools (Seitsinger, 2005; Thacker et al., 2017). Shifting from a traditional direct instruction approach to PBL presents many challenges

for teachers. Prior research on challenges educators face when implementing PBL has identified several challenges: these challenges relate to (1) contexts, (2) teacher practices, and (3) teacher beliefs.

In terms of context, teachers report challenges that include: standardized testing pressure, time constraints, and lack of administrative interest and support from school leaders (Harris et al., 2015; Thacker et al., 2017, Viro et al., 2020). Thacker et al. (2017) reported "high-stakes tests" as one of the top five concerns teachers had when seeking to incorporate more inquiry activities into their regular classroom practice. Dover and Schultz (2018) further pointed out that in addition to concerns about state testing, teachers also need to be responsive to diagnostic assessments given by school divisions to evaluate students' likely performance on state tests. This pressure to ensure student success on standardized exams presents a challenge for teachers who are uncertain if implementing a new practice like PBL will allow them to achieve and maintain high test scores.

In addition, curriculum and pacing guides often present challenges for teachers who do not have planning time and resources to design PBL experiences for their students. In particular, learning how to address all the standards for a given content area and deliver high quality PBL within a traditional 45-minute class schedule is challenging. PBL thrives with longer class periods that allow students time for in-depth research, collaboration, and connection to experts in the field - all of which are challenging to enact during a shorter class period. Harris's (2014) survey of 49 K-12 teachers found that "implementing the project during the school schedule" was one of the top five concerns for teachers. Viro et al. (2020) also found that inflexible scheduling was a frequently reported barrier by the Finnish teachers. These findings suggest that teachers feel that PBL requires a more flexible school schedule that allows longer class periods to complete projects.

In addition, the lack of interest and support from administration for implementing PBL can lead to insufficient time allocated and ambiguous priorities for teacher collaboration in executing PBL projects. In one study, Capraro et al. (2016) found that even though teachers had a designated time for PBL planning meetings, school leaders often interrupted these meetings with competing priorities. Haatainen and Aksela (2021) also found that teachers reported lack of time to plan with colleagues, creating a challenge for implementing PBL. This feeling that there

is not enough time to implement PBL given many school schedules adds another challenge for teachers interested in implementing PBL.

The lack of a clear vision from school administrators on the purpose and method for implementing PBL can be a source of the misalignment of school structures needed for PBL implementation. In their qualitative study with 25 staff members at one middle school, Park and Ertmer (2008) found that a lack of shared vision between the teachers and the administrators created confusion on the part of the teachers and a lack of commitment to richly implement PBL. Dunbar and Yadav (2022) had similar findings in their multiple-case study with middle school teachers. One participant shared his reluctance to implement PBL by explaining, "I think that when it comes to project-based learning, it would be difficult to cover your own ass, quite frankly, if that's [PBL] what you were doing all the time" (p. 29). Without clear support from his administrator, this teacher wasn't willing to implement PBL as a regular part of his classroom instruction. These multiple challenges can leave individual teachers feeling too daunted to take on the demanding shift to the student-centered classroom required for PBL.

Individual teachers have very little control over external barriers (testing, schedules, administrators). However, instructional challenges that are unique to student-centered teaching approaches like PBL are related to teacher practices, over which teachers do have control. Learning to become a facilitator and scaffolding projects for diverse learners are commonly reported challenges to implementing PBL. While many teachers report that they see themselves as a facilitator, they also share that shifting control to students is challenging (Wilson, 2021; Thacker et al., 2017). In a literature review by Hasni et al. (2016), teachers identified one of their challenges as "balancing student engagement in dialogic versus monologic or authoritative discussion interactions" (p.211). Getting comfortable allowing students to take the lead in discussions, problem formulation, and research can be disconcerting for teachers (Avishai & Palatnik, 2022; Markula & Aksela 2022). Grant and Hill (2006) agreed that the extent to which a teacher can tolerate the dynamism and ambiguity of a PBL classroom will influence that teacher's implementation of PBL. The non-linear structure of PBL, coupled with an emphasis on student voice and choice can be a difficult shift for teachers.

In addition to contextual constraints and challenges to changing teacher practices, teacher beliefs also play a role in PBL implementation. Even though research has shown PBL to be effective with a diverse range of students (Halvorsen et al., 2012; Marx et al., 2004), a common

concern among teachers regarding PBL implementation is the difficulty of applying it to all students, irrespective of their previous learning experiences, background knowledge, abilities, or interests (Wilson, 2021). In one study, Thacker et al. (2017) found teachers reported students' limited background knowledge as one of the top concerns about implementing inquiry-based learning activities in their classrooms. Likewise, Capraro et al. (2016) found that teachers indicated that students' lack of metacognitive skills, limited background knowledge, and underexposure to student-centered learning poised challenges for implementing PBL. In two of the three cases presented by Rogers et al. (2011), teachers expressed concerns about students' lack of experience with PBL and the emphasis PBL places on self-motivation. These two teachers also questioned whether 9th graders had the metacognition necessary to complete PBL units. Thus, teacher beliefs about students' lack of ability to be successful with PBL is a commonly reported challenge to PBL implementation.

Extant research has shown that teachers report many challenges to implementing PBL that involve their school contexts, teaching practices, and teaching beliefs. Teachers find institutional barriers in their contexts (time constraints, standardized testing pressure, lack of administrative support), in their teaching beliefs (about the ability of all students to participate in PBL), and instructional challenges in their teaching practice (shifting control to students and scaffolding projects for diverse learners) overwhelming, resulting in a limited number of teachers willing to implement PBL in most K-12 settings.

Enabling Conditions for Project-based Learning

While challenges teachers face when implementing PBL have been widely examined, research has also focused on why some teachers and some schools have successfully implemented PBL in their courses, their grade level, or their entire school despite the challenges discussed above. There is a growing body of research that examines the enabling conditions required for PBL to thrive. Three themes emerged from this research: (1) the need for high quality collaborative professional development (PD), (2) supportive school leadership that also allows for teacher agency, and (3) opportunities for teachers to reflect on student outcomes in professional learning communities (PLC).

Properly enacted PD can be a vehicle for increasing implementation of PBL in a school. Fallik and colleagues (2008) found that teachers who participated in long-term PD increased in confidence in key aspects of PBL such as choosing a driving question, facilitating peer

evaluation, and fostering question asking. In addition, novice PBL teachers reported that direct support from the PD facilitators positively influenced their ability to implement PBL. Similarly, Farrow et al. (2022), found that teachers that had prior PBL PD were more likely to engage students with projects, promote collaboration, and use driving questions. One specific aspect of PD that is influential is the duration of the PD. Prior research has suggested that PD that lasts more than a year can help teachers gain the knowledge and confidence needed to implement PBL (Mentzer et al., 2017). PD is helpful for teachers to understand the structures of PBL like driving questions and student collaboration. Longer-term, sustained PD gives teachers support to move past understanding these key features towards implementing and integrating them into their classroom practice.

In addition to the importance of professional development opportunities that are ongoing and sustained, research also indicates that PD should include opportunities for collaboration and resource development (Borko, 2004; Darling-Hammond & McLaughlin, 1995; Desimone & Garet, 2015). Teachers benefit from professional communities of practice that offer peer support for implementation of new pedagogies (Akerson et al., 2009; Printy, 2008; Ritchie, 2012; Wenger, 2000). For instance, in Krebs's (2008) phenomenological study of seven teachers enacting service learning, a practice similar to PBL, one of themes that emerged was the importance of teachers being able to connect with each other. Teachers benefited from the opportunity to coordinate alignment of projects with curriculum, plan details of projects, and to problem-solve when challenges arose with project implementation. In another study, Capraro et al. (2016) found that teachers who were given additional planning time to meet and collaborate with peers found it extremely beneficial for the enactment of new strategies: "we help each other all the time" (p. 192). Similarly, teachers in the Herro & Quigley (2017) study highlighted the importance of time for peer collaboration during PBL professional development sessions in the summer. They emphasized that allocating similar collaboration time during the academic year is crucial for PBL's successful execution.

Another factor that plays a role in teachers' adoption of PBL is school leadership that provides a school vision and supports communities of practice as described previously. Teachers who are reluctant to implement PBL may turn to their administrator to get confirmation and support. Dunbar and Yadav (2022) found that one teacher asked her principal for a "green light" which then gave her comfort to enact PBL in her classroom. Once the principal was explicit with

this teacher who was looking to enact PBL, she felt more confident moving forward. Some teachers find it difficult to implement PBL without explicit criteria or feedback from school administrators. For example, Park and Ertmer (2008) found that teachers feel uncertain about their implementation of PBL due to a lack of feedback and evaluation from school administrators. One teacher said, “I still don’t know what I’m doing or if I’m doing it right” (Park and Ertmer, p. 639). Clear, direct encouragement from school leadership enables teachers to feel confident moving to a student-centered practice like PBL.

In addition to getting feedback from school leaders, teachers enacting PBL benefit from leaders who convey a sense of trust in how teachers may need to adapt materials or lessons to be effective in their classrooms. For example, Potvin et al. (2022) found that the teachers who felt free to break away from prescribed curriculum were able to implement PBL more readily. Miller, and colleagues (2021) recommended that teachers should be encouraged to get deeply involved in PBL units by adapting materials, being innovative in their teaching, and being responsive to student and community cultures. While it is important for school administrators to provide support and guidance to teachers enacting PBL, being overly prescriptive can also inhibit teachers’ implementation of PBL. Zuckerbrod and colleagues (2021) recommended that teachers be given agency to adapt PBL to meet their students’ needs. Administrators should give clear guidance for PBL while trusting teachers to adapt PBL in a manner that is responsive to their students. Fostering this trust between teachers and leadership is an important factor in enabling PBL implementation in schools.

As suggested earlier, professional learning communities can serve to both provide ongoing professional learning for teachers and encourage teacher agency. In addition, PLCs are a good place for teachers to reflect on their implementation of PBL and notice student and teacher outcomes. Studies indicate that student engagement is high when participating in PBL. Specifically, PBL can elicit productive disciplinary engagement which is when students are engaged in goal-oriented interactions with authentic disciplinary purpose (Potvin et al., 2022). Teachers often find this high engagement fulfilling and therefore, want to implement more PBL (Zuckerbrod et al., 2021). In addition, teachers, motivated by high student engagement, become more interested in adapting PBL materials to be more responsive to their students (Miller et al., 2021; MacMath et al., 2017). This desire to adapt PBL units reinforces a sense of teacher agency which continues to strengthen teachers’ desire to implement PBL. PLCs have shown to be a

space where teachers are able to share and reflect on student engagement while also problem-solving and adapting materials together (Coenders & Terlouw, 2015). The role of high-quality, sustained PD; specific administrative support, and vibrant, supportive PLCs; and time to reflect on the high student engagement seen with PBL, have the potential to broaden and widen the implementation of PBL in a school.

These enabling conditions for PBL - high quality, collaborative PD, supportive school leadership, and opportunities for teachers to reflect on student outcomes in PLCs - offer promising strategies for schools to enact to foster high quality PBL. However, more research is needed to understand how teachers interpret these enabling conditions and respond in a way that truly shifts their practice towards PBL. While these studies present some promising direction, deeply exploring and comparing three different contexts of schools implementing PBL can provide additional support for these findings and may point to new implications for practice by understanding the underlying motivational mechanisms that may be taking place. In this study, I will use a theoretical framework that focuses on teacher motivation via social cognitive theory. By taking this approach, using a social cognitive framework and a multiple case study, this study can serve to deepen our understanding of how these enabling conditions influence teachers.

Social Cognitive Theory as a lens for understanding PBL implementation

Social cognitive theory offers one lens to more deeply understand how the reported challenges to and the suggested enabling conditions for implementing PBL are related. Social cognitive theory, postulated by Bandura (1986), theorizes that a triadic reciprocality exists between *behavior*, *cognition*, and the *environment* that influences an individual's motivation to learn and demonstrate learning. Bandura did not believe that humans only respond to external stimuli, but rather that they interpret both input from the environment and interpret how effective they think different responses will be in responding to that stimuli. Bandura posited that human agency is a key factor in understanding human behavior and motivation. Bandura further asserted that peoples' thoughts and beliefs affect how they behave and the social environment shapes those beliefs and expectations.

In terms of schools and education, students and teachers also maintain and alter behaviors due to the relationship among behavior, cognition, and the environment. Bandura (1997) insisted that there is free will but that our actions are contingent upon our environment and how we interpret our environment. Considering how this triadic reciprocality plays out for teachers in

schools can inform how we understand the motivation a teacher has to plan, execute, and iterate the implementation of PBL in their classrooms. By examining the environment of schools that are working towards implementing PBL, we can consider how the environment may be influencing teacher behavior. However, we also need to understand how teachers are interpreting their environment; therefore, in-depth interviews that are situated in three different contexts can offer some insight into how teachers may be interpreting their environment as it influences their behavior: in this case, their behavior in regards to implementing PBL.

Teacher Self- and Collective Efficacy and Learning

Defining Teacher Self-Efficacy

A basic component of social cognitive theory is the role of self-efficacy. Understanding how self-efficacy beliefs interact within the triadic relationship of behavior, environment, and cognition is foundational to social cognitive theory. Bandura (1986) argued that an important construct for behavior change is self-efficacy beliefs, which are "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). In other words, an individual's belief in their ability to produce certain outcomes will determine the extent to which they will try new behaviors and persist in these behaviors. These "given attainments" or signs of successful experiences for teachers have been defined as being related to student achievement, student behavior, and student motivation (Woolfolk & Hoy, 1990). An important aspect of Bandura's (1986) theory is that self-efficacy determines how much effort is put into a task and how willing an individual is to push through barriers to successfully complete a task. Consistent with Bandura's theory is the idea that teachers with high self-efficacy will consider implementing innovative practices like PBL a challenge to be taken on, not one to be avoided. Thus, a teacher with well-developed self-efficacy for PBL implementation would believe in their own capability to implement PBLin a way that produces high student achievement, positive student behaviors, and high student motivation.

Prior research about self-efficacy and innovative practices supports this idea that teachers with high self-efficacy are more likely to implement innovative practices like constructivist teaching, collaborative learning, and content literacy instruction. In their study of 25 teachers in Lebanon who were beginning to implement a new cooperative teaching method, Ghaith and Yaghi (1997) found a high correlation between self-efficacy and teachers' beliefs that the cooperative learning strategy was congruent with their own practices. This correlation between

efficacy and sense of congruency with their practices led teachers to implement the strategies more frequently. Cantrell and Callaway (2008) worked with 16 teachers who were participating in a year-long professional development experience learning how to integrate literacy practices into their content areas. The authors also found a significant correlation between teachers with high self-efficacy and implementation of the content literacy strategy. The authors advocated for professional development that takes teacher self-efficacy into account. Nie and colleagues (2013) also found similar results in a quantitative study of teachers in 40 primary schools in Singapore. They found a high correlation between high self-efficacy and innovative teaching practices like constructivist teaching. Based on their findings, the authors recommended that schools that were striving for more constructivist teaching should focus on raising teacher self-efficacy. While there is emerging research in this area, more research is needed to further understand this relationship between teacher self-efficacy and implementation of innovative practices, such as PBL (Choi et al., 2019). In addition, research needs to also examine the mechanisms that produce high teacher self-efficacy, such as how sources of efficacy contribute to teacher efficacy.

Sources of teacher self-efficacy

Bandura (1997) established four sources of self-efficacy. These sources are *mastery experiences, vicarious experiences, social persuasion*, and *affective states*. *Mastery experiences* encompass successful experiences executing an intended behavior. Individuals complete a task, evaluate how they did on that task, interpret the degree of success in completion of the task, and then determine if they think they will be successful on that task in the future (Usher & Pajares, 2008). Mastery experiences are theorized to be the most powerful (Bandura, 1997). *Vicarious experiences* are when individuals observe others successfully performing the actions required to achieve a desired result. It is important that the individual sees the person and the context being observed as similar to the individual's own experiences. In school settings, students may see a peer successfully complete a task and think that if that student can complete the task, so can they. However, vicarious experiences can be vulnerable to social comparison. If a student sees a peer perform more successfully on a task than they did, their efficacy may be shaken, thinking they are not as competent as they thought (Usher & Pajares, 2008). Bandura (1997) theorized that vicarious experiences are less influential than mastery experiences due in part to the complicated impact they have on individuals. *Social persuasion*, sometimes referred to as verbal persuasion,

involves positive reinforcement from others, expressing belief in the ability to carry out the task. Social persuasion can come in many forms and is most influential when it is specific and actionable (Bandura, 1997). Finally, *affective state* refers to the physiological and emotional response to the condition being sought. If individuals have positive emotions and physical reactions while doing a task, they are more likely to rate themselves as successful on that task, increasing their sense of self-efficacy. However, if an individual feels nervous or stressed during a task, they are more likely to evaluate their competence as lower on that task.

The majority of studies that consider the sources of teacher self-efficacy focus on *mastery experiences*. One challenge of studies focused on the role of mastery experiences is how to define what comprises a mastery experience for teachers. Many studies have focused on successful teaching as the mastery experience but vary in how successful teaching is measured. Some studies focus on teacher assessments of their feeling of success while others focus on student performance as a result of instruction (Morris et al., 2017). Morris recommends that research about the role of mastery experiences as a source of self-efficacy focus on teachers' direct actions and the resultant student outcomes. For instance, teachers may interpret positive student behavior, engagement, and comprehension of content as signs of mastery experiences as these have been shown to influence teachers' self efficacy (Gabriele & Joram 2007; Phan & Locke 2015). More research is needed that focuses on these aspects of successful teaching that informs mastery experiences as a source of self-efficacy. While there is limited research on the role of mastery experiences for teacher efficacy related to PBL implementation, it may be that clearly defining mastery experiences for PBL implementation could assist with teacher development of efficacy for PBL. Because the student outcomes for PBL should encompass both content knowledge and interpersonal and intrapersonal skill development (communication, collaboration, problem-solving skills, self-reflection), teachers need help naming what successful PBL implementation looks and feels like in order to recognize mastery experiences. Further research is needed to determine if clarity of what PBL implementation should look and feel like helps teachers to interpret experiences as mastery experiences.

Research on *vicarious experiences* has focused on the roles of mentor teachers, peer observation, and video lessons. Teachers have reported that exposure to each of these have influenced their self-efficacy (Morris et al, 2017). A key component of the influence of vicarious experiences is that the peer or model is seen as someone similar to the participant (Bandura,

1977). Research on vicarious experiences has yielded nuanced findings. In one study, Morris and Usher (2011) found that award-winning college professors reported that exposure to how other professors teach had both positive and negative influences on their self-efficacy and varied in unpredictable ways when the teaching models were more or less-abled. Furthermore, there is a great deal of research on pre-service teachers and the role of mentors and models but much less so about inservice teachers. K-12 classroom teachers often have very little opportunity to observe other teachers, making research that is focused on informal exposure to vicarious experiences important. Future research may investigate the role of professional learning community conversations or casual observations as informing self-efficacy (Morris et al., 2017). In addition to considering informal or casual exposure to peer models in schools, it is also important to understand to what extent web searches, project databases, and conference presentations can serve as vicarious experiences for teachers as these are also methods that many teachers have for learning about PBL implementation.

When considering *social persuasion*, researchers have asked teachers to reflect on evaluative feedback and other messages they receive about their teaching. Social persuasion is most impactful when it is clear and specific and when the source of the social persuasion is credible to the participant (Bandura, 1986). Tschannen-Moran and McMaster (2009) examined the influence of four different formats of professional learning about new reading strategies on teacher self-efficacy. They found that the PD format that included coaching which provided a great deal of evaluative feedback had the greatest impact on teacher self-efficacy. This indicates the importance of social persuasion for teaching self-efficacy. In another study, Bümen (2009) found that PD involving teacher collaboration created opportunities for social persuasion through peer feedback, which, in turn, enhanced self-efficacy. Teachers in this study found that feedback from their peers during the professional learning on effective teaching practices provided specific and actionable feedback that increased their confidence in teaching. Morris and Usher (2011) interviewed award-winning college professors and found that awards were a significant source of social persuasion for these professors. A clear indicator that they were skilled as professors was an award that came with specific praise for their skills. Social persuasion in the form of feedback from peers, coaches, or outside organizations may be influential in teachers' self-efficacy for PBL implementation; more research is needed to understand these various methods of social persuasion and how that influences self-efficacy for PBL implementation.

The role of *affective states* as a source of teacher self-efficacy has been studied the least of the four sources of self-efficacy. However, Morris et al., (2017) found in their critical review of teacher efficacy research that there is a small body of literature that indicates that teachers who report positive feelings during or following teaching have higher self-efficacy. A study by Gabriele and Joram (2007) with newcomer and veteran elementary school teachers implementing a reform-based mathematics program found that veteran teachers more commonly expressed emotional states when describing past lessons and were more likely to do so when commenting on student thinking than on student academic goal progress. Burić and Moè (2020) also found in their study with 536 Croatian high school teachers that positive affective states were highly correlated with teacher efficacy. Similar to the other sources of self-efficacy, more research is needed to determine the directionality of this relationship. Is it that self-efficacious teachers are better at regulating their emotions? Or that when teachers have positive emotions while teaching, their self-efficacy improves? In terms of PBL, positive affective states may relate to the enjoyment of teaching PBL and responding to student engagement. It may also relate to a positive affective state that comes from implementing a teaching pedagogy one finds satisfying. However, affective states may also operate in a way that lowers self-efficacy. If teachers find implementing PBL difficult or challenging, the resulting negative affective state such as stress or anxiety may lower a teacher's self-efficacy for implementing PBL. More research is needed to more thoroughly understand the relationship of affective states with self-efficacy in terms of PBL implementation.

Defining Collective Efficacy

An important aspect of the four sources of teacher self-efficacy is the context in which teachers work: the culture of the school, the teachers they work with, and the students they instruct. In addition to their own teacher self-efficacy, teachers are also influenced by their sense of collective efficacy. Collective efficacy is the result of shared beliefs in collective power to achieve desired results (Bandura, 2000). In other words, collective efficacy is the extent to which it is believed the organization (school staff) can execute the behaviors required to produce a specific outcome as a group (Goddard et al., 2000). The relationship between teacher self-efficacy and collective efficacy is more than the sum of its parts. Due to the interdependent nature of work in schools, collective efficacy is not just the aggregate of each individual staff member's teacher self-efficacy, it is an "emergent, group level property" (Bandura, 2000, p. 76).

Teachers report different levels of efficacy in responding to measures of their own teacher self-efficacy when compared with their perception of collective efficacy (Geer & Morrison, 2008; Ninković & Florić, 2016); furthermore, teachers perceive collective efficacy differently when asked to consider their grade level team compared to the staff as a whole (Prelli, 2016). Therefore, when considering the influence of efficacy on student learning, collective efficacy represents a separate construct that refers to the belief in the capabilities of the staff as a whole.

Sources of Collective Efficacy

The sources of collective teacher efficacy have been identified as the same as those for self-efficacy: *mastery experiences*, *vicarious experiences, social persuasion*, and *affective states* (Bandura, 1977; Goddard et al., 2000). Research conducted on collective teacher efficacy has examined these sources of collective efficacy. For instance, Goddard & Hoy (2000) found that collective teacher efficacy is positively associated with student achievement, often considered an example of mastery experiences for collective efficacy. Tschannen-Moran and Barr (2004) also found that there was a significant relationship between teacher perceptions of collective efficacy and student achievement. In addition, in a more recent study by Goddard et al. (2017), high collective efficacy was not only associated with high achievement in general but was also associated with a lowered achievement gap between Black and White students. While these studies suggest that collective efficacy predicts student achievement, it may also be true that teachers see this continued success as an indicator of *mastery experiences* for the school staff. High student achievement across a school could be an indicator to teachers that the school staff is successful in one of the main objectives of teaching: student achievement. This noted success can be seen as a source of mastery experiences for a school staff. Exploring the extent to which the relationship between collective teacher efficacy and student achievement is reciprocal needs continued exploration. In terms of mastery experiences for PBL implementation, there is scant prior research that has determined the best way to define mastery experiences of school-wide PBL implementation. More research that seeks to determine how teachers define examples of mastery experiences for PBL implementation is needed.

As well as considering the role student achievement plays as a source of mastery experiences for collective teacher efficacy, a second source of collective efficacy, *vicarious experiences*, also needs further exploration. Meyer et al. (2022) describe vicarious experiences for collective efficacy as an "individual's experiences of the other individual group members'

past successes" (p. 596). Donohoo et al. (2020) describe teachers observing or collaborating with each other as examples of vicarious experiences for collective efficacy. Due to the interdependent nature of collective efficacy, school culture that promotes teachers learning from each other will provide both vicarious experiences for teachers to learn from their colleagues and will serve to reinforce mastery experiences as teachers observe the successful performances of the teachers they work with. Collective efficacy has been found to be high in schools with high support for teacher collaboration. For instance, Strahan née Brown and colleagues (2018) studied 14 primary schools in England using both surveys and teacher interviews about teacher beliefs around the sources of their collective efficacy. Researchers identified four sources in the teacher's accounts including "learning." In the schools with comparatively high levels of collective efficacy, teachers reported "learning" by observing others and participating in productive team meetings. Teacher collaboration was also discussed in the Goddard et al. (2017) study of elementary and middle schools in Texas. Similar to the Strahan née Brown et al. study, focus group responses indicated that one source of teachers' collective efficacy was peer observations. Being able to observe other teachers teaching as a standard part of school culture provides vicarious and mastery experiences for teachers and can contribute to high collective efficacy among school staff. In addition to vicarious experiences consisting of learning from and with each other, there are additional ways to conceive of vicarious experiences. Considering that collective efficacy is about the belief regarding a school's ability as a whole, and not the sum of each individual teacher's self-efficacy, it also seems logical to define one kind of vicarious experiences for collective efficacy as those in which teachers compare their school's ability with another school's ability. Goddard (2004) recommended defining vicarious experiences for collective efficacy as observing instruction at other schools. More research that examines how mastery experiences and vicarious experiences relate to or reinforce each other as sources of collective efficacy would be useful for understanding how to increase collective efficacy in schools.

A third source of collective efficacy is *social persuasion*. Research has also shown that schools with high collective efficacy set norms for high "academic press," that is, setting high standards and expectations for students. In the study by Goddard et al. (2017), teachers shared that in the schools with high collective efficacy there was a norm that teachers would do whatever it took to help students succeed. Similarly, in the study by Strahan née Brown et al.

(2018), one of the four identified sources of high collective efficacy was "Communication," specifically formal and informal communication between senior leaders and staff and informal communication among staff that provided clarity and encouragement to teachers that as a staff, they were performing successfully. Donohoo and colleagues (2020) also used "Goal Consensus" as one sub-scale of their measure of enabling conditions of collective teacher efficacy. The authors based this decision on the fact that clear expectations give teachers clarity on how to act and how to know they and others are being successful. In Versland and Erickson's (2017) case study, they saw collective efficacy developing via social persuasion through two different vehicles: relationship-building and teacher leadership. In the focus school of their study, there were strong relationships among staff , which resulted in a great deal of professional encouragement. Furthermore, the principal fostered teacher leadership that empowered teachers to take on leadership roles which built up their confidence in their own abilities. These studies show that schools with policies and procedures that support collaboration and problem-solving provide opportunities for positive social persuasion which leads to higher collective efficacy.

Research has also shown the importance of *affective states* as a source for collective efficacy. Collective efficacy in schools refers to the psychological and emotional state of the staff. Affective states relate to two of the themes identified by Strahan née Brown et al. (2018). "Supporting roles" referred to senior management and peers that are supportive. In schools with high collective efficacy, teachers shared how "we support each other emotionally" and "look after each other's well-being" (Strahan née Brown et al., p. 153), fostering positive affective states. A second theme of Strehan née Brown et al. (2018) findings was "stress management" which showed that in schools with low collective efficacy, not only was stress high but teachers felt school leadership did not provide methods for helping them to manage that stress. Furthermore, Adams and Forsyth (2006) identified that "enabling school structures" had a large independent effect on collective teacher efficacy. They identified "enabling school structures," as those that, "bring people together… foster trust, and they promote collective ownership" (p. 640), which helped to establish a positive culture among school staff members. By providing school culture that offers opportunities for problem-solving and collaboration, teachers will feel more empowered to overcome challenges, leading to more positive affective states.

Lack of Research About PBL and Self- and Collective Efficacy

Project-based Learning and Teacher and Collective Efficacy

Prior research that has examined the relationship between PBL and teacher efficacy have mainly been short term and have focused on the effect that PD or coursework has on teachers' efficacy for PBL. These studies show a general increase in self-efficacy after PD, with teachers feeling more confident about their ability to enact a project with students (Toombs et al., 2022; Choi et al., 2019; Mirici & Uzell, 2019). At the same time. research has also found that some aspects of teacher self-efficacy didn't improve or even decreased. For instance, Choi and colleagues (2019) found that teachers didn't feel confident in their ability to manage student behavior during projects even after the PD. Similarly, teachers have also reported to be less confident in their ability to complete project reporting required as part of PBL for their schools (Mirici and Uzell, 2019; Toombs at al., 2022). In another study, Hodge and colleagues (2016) found that teacher self-efficacy was high prior to the PD and remained high throughout. These studies reinforce the general positive relationship among high-quality PD, self-efficacy, and PBL implementation but also reveal some questions about the extent to which self-efficacy can be raised during PD. However, because each of these studies only examines a short-term change in self-efficacy, more work is needed to understand how these relationships are sustained over time. Exploring how self-efficacy might predict wider and broader implementation of PBL above and beyond initial PD or a single PBL attempt has not been thoroughly examined. Furthermore, these studies demonstrate that defining self-efficacy linearly, something that can only be raised or lowered, may be limited. A model of self-efficacy that defines stages of self-efficacy or stability of self-efficacy may offer more insight into how self-efficacy influences teacher practice.

Research about the relationship of collective efficacy and PBL is even more limited. There are, however, a number of studies looking at the role of school leadership in supporting collective efficacy. While these studies do not specifically discuss PBL, they have implications for enabling conditions for PBL implementation since, as stated earlier, enabling school conditions for PBL include supportive leadership. Meyer and colleagues (2022) found that when principals were engaged in instructional and staff development leadership practices, there was also a high level of collective efficacy in the school. A school leader that demonstrates knowledge of and expertise in the instructional practices being taught in PD can positively influence the collective efficacy at that school. Versland and Erickson (2017) also found that when school leaders promoted fidelity of implementation to instructional initiatives and relationship building, collective efficacy was high. Clear, consistent messaging from school

leaders about instructional initiatives can raise collective efficacy. Ninković and Florić (2016) found that specific aspects of transformational leadership had a positive correlation with collective efficacy. They found positive associations between collective efficacy and leadership that was perceived as "developing people" and "setting direction." However, they found no significant association between collective efficacy and leadership that was seen as "redesigning the organization" and "improving the instructional program." This study indicates that a school leader that is clear in their instructional vision while also being supportive of staff fosters high collective efficacy. While these studies do not directly address PBL implementation, they indicate some possible directions for research about the potential connection among collective efficacy, supportive leadership, and PBL implementation. More research that examines the influence of school leadership on collective efficacy for PBL implementation is needed to determine if these same factors increase collective efficacy for PBL implementation.

Project-based Learning and Sources of Teacher and Collective Efficacy

More research is needed on the sources of collective efficacy. In the 2010 literature review by Klassen et al., and the 2020 critical literature review by Hoogsten, the authors argued that more research is needed about how these sources influence collective efficacy and how they work in relation to each other. Donohoo (2018) also called for research that seeks to understand how collective efficacy is shaped and what are the enabling school conditions that contribute to high collective efficacy. Furthermore, more research is needed to thoroughly understand how the four sources of collective efficacy relate to each other and reinforce one another (Donohoo, 2018; Klassen et al., 2011; Morris et al., 2017). Zhou (2019) also argued that there currently exists only a "a modest understanding of how teachers' collective efficacy is *influenced by context* and how it changes over time" (p. 80). This study will seek to deeply probe how the four sources of teacher self- and collective efficacy influence teachers in implementing PBL. By focusing on schools with different contexts and conducting in-depth interviews with teachers and school leaders, participants will be able to offer insights into the extent to which different aspects of the sources of efficacy influence their implementation of PBL.

Study purpose, design, and research questions

In the following section I will discuss how this study connects to prior research done in social cognitive theory and PBL implementation by outlining this study's purpose, design, and research questions.

Purpose of this study

While there is a growing body of research demonstrating the multiple benefits of PBL, PBL remains an underutilized teaching approach in K-12 schools in the United States. If students are to benefit from PBL as a promising practice, it is essential that we understand more deeply why some teachers and schools adopt PBL and others don't. Initial work in this area has indicated that teachers report a number of challenges that make implementing PBL difficult. Challenges such as time constraints, pressure from standardized testing, and administrative disinterest present barriers to PBL implementation. In addition, teachers share that moving to PBL presents instructional challenges that involve shifting to a student-centered classroom. A growing body of work has begun to explore what enabling conditions can be introduced to overcome these challenges and promote the implementation of PBL more widely. These studies point to high quality collaborative PD, supportive school leadership that also allows for teacher agency, and opportunities for teachers to reflect on student outcomes in PLCs. While these studies have documented promising practices for schools interested in wider PBL adoption, understanding the motivational mechanisms behind these practices can help educators and leaders more fully enact these enabling conditions.

Social cognitive theory is a theory of motivation that takes into account teachers' behavior, environment, and cognition (Bandura, 1986). Specifically, teacher self-efficacy and collective teacher efficacy have been shown to be influential in a teacher's adoption of new instructional methods in the classroom. Prior research has sought to understand how teacher efficacy is developed by highlighting the role different sources of efficacy have on building high teacher efficacy. These sources – mastery experiences, vicarious experiences, social persuasion, and affective states – have been shown to contribute to teachers' development of efficacy. While some initial strides have been made to understand how these sources influence teachers' efficacy in terms of PBL implementation, more needs to be done to thoroughly understand this relationship. This study seeks to explore more deeply and comprehensively into how these sources play in teachers' decisions to implement PBL in their classrooms. Furthermore, this study seeks to understand how whole schools, not just individual teachers, build efficacy for PBL implementation. Understanding how the sources of collective efficacy play out for PBL implementation can help address why some schools are successful with widespread

implementation while other schools only have a small number of teachers implementing PBL, if any at all.

Study design

A multiple case study based on semi-structured, in-depth interviews allowed me the opportunity to both delve deeply into how teachers thought about the sources of self- and collective efficacy in terms of their PBL implementation and to explore three different contexts of schools implementing PBL. Bandura (1997) stated that it is an individual's interpretation of mastery experiences, vicarious experiences, social persuasion, or affective states that influences their sense of efficacy. Therefore, interviews were ideal for understanding how teachers think about these sources of efficacy in terms of their PBL implementation. In addition to the self-reporting nature of interviews, I employed document analysis to analyze multiple sources of information about each school. These documents allowed me to triangulate data from the interviews and determine additional ways in which the sources of efficacy were playing out in each school.

Multiple case studies are ideal for exploring theory that is not yet fully established (Yin, 2018). By choosing three schools from which to develop case studies, I was able to observe how the sources of efficacy played out in each school. Comparing schools from different geographical areas, with different student populations, and differing experiences with PBL, I was able to both find aspects of social cognitive theory that manifested in consistent ways across all three schools and elaborate on ways that each school's context resulted in different sources of efficacy being influential. Multiple case studies are ideal for exploring theory that is not yet fully established (Yin, 2018). Understanding the ways sources of efficacy, especially collective efficacy, influence teachers in their PBL implementation is newer territory and this study contributes new insights into what will support wider implementation of PBL.

Research questions

Determining the role of self- and collective efficacy in teachers' motivation to implement PBL could offer one lens to understand why some teachers enact PBL regardless of barriers, and others see those barriers as insurmountable as well as what school factors encourage PBL implementation or discourage implementation. While there is a nascent body of research examining enabling conditions for the enactment of PBL (Potvin et al., 2022), the present study would examine this issue from a teacher efficacy perspective. Using a social cognitive theory

lens, this study will provide a unique viewpoint that will add new dimensions to the current understanding of the role of teacher efficacy in implementing innovative pedagogies like PBL in schools. Specifically, this study would ask the following research questions:

- What role do sources of self- and collective efficacy play in teachers' self- and collective efficacy for PBL implementation?
- How does the role of the sources of self- and collective efficacy for teachers' implementation of PBL differ across different contexts?

CHAPTER THREE: METHODS

Holistic multiple-case study

Given the focus of this study on teacher self- and collective efficacy across different schools, this study uses a holistic multiple-case study approach where each school is the unit of analysis. Specifically, this study focuses on the sources of teacher self- and collective efficacy in schools that are implementing PBL. Each school will be considered as a separate case with staff interviews and document analysis conducted to understand the context of the school as a whole. A holistic multiple-case study approach best addresses my research questions regarding the sources of teacher self- and collective efficacy in regards to PBL implementation. Case studies serve as real-world cases and as opportunities 'to shed empirical light on some theoretical concepts or principles" (Yin 2018, p. 38). Structuring this study as a multiple-case study allowed me to richly describe how teachers and school leaders perceive sources of efficacy and PBL implementation, while also describing different contexts where teachers are implementing PBL. Different contexts have been found to influence teachers' development of self-efficacy beliefs and the extent to which each source of efficacy influences their beliefs (Phan & Locke, 2015).

As this study is interested in how the sources of efficacy influence teachers in their implementation of PBL, employing qualitative methods with an interpretivist approach allowed me to explore teacher's complex interpretations of the sources of efficacy. Morris and Usher (2011) argue that qualitative studies about the sources of efficacy can highlight the interconnected ways individuals process the four sources of efficacy and can provide clear examples of the internalization of information as sources of efficacy. Using an interpretivist approach highlights how teachers interpret and make sense of their experiences with implementing PBL (Glesne, 2016). A great deal of research on teacher self- and collective efficacy has taken a quantitative approach, using self-report surveys as measurement tools (Klassen, 2011; Hoogsteen, 2020). This body of research has established a strong correlation of high self-efficacy and collective efficacy with student achievement. However, these research perspectives and processes rely on measurement tools that do not get at underlying cognitive processes. This study seeks to use an interpretivist multiple-case study approach to holistically describe how the sources of teacher self- and collective efficacy related to PBL implementation develop self- and collective efficacy in different contexts.

Because I approached my research questions with a social cognitive lens, it was important that I collected and analyzed qualitative data that included teachers, school leadership, and school materials. I needed to understand not just how teachers perceive the sources of efficacy on their PBL implementation but how the school operates with them and around them to influence their efficacy. To uncover the cognitive process of teachers' developing self- and collective efficacy – how teachers process their experiences in schools in terms of their efficacy – I conducted semi-structured interviews with teachers and school leaders at each school. These interviews focused on the sources of self- and collective efficacy (mastery experiences, vicarious experiences, social persuasion, and affective states) and how they supported teachers' efficacy when implementing PBL. In addition to these interviews which are the core of the case studies, I also collected and analyzed school data and school-specific artifacts related to PBL implementation. Documents analyzed as part of a case study can contextualize information and verify other sources of information (Bowen, 2009; Flick, 2022). This two-pronged approach of conducting semi-structured in-depth interviews and document analysis formed a rich base of data for me to develop these three case studies.

Case selection

To deeply understand the factors that influence teacher efficacy in schools, I contacted middle and high schools that are implementing PBL across the nation. After securing IRB approval from Michigan State University, I began recruiting for school participation in the study. I contacted schools in three different ways. (1) A nationally recognized PBL organization (PBLworks, https://www.pblworks.org/) distributed a one-page description of my research project via their newsletter to participating schools. (2) I applied to conduct research in school divisions or states that have been recognized as award-winning by national PBL organizations (PBLworks, https://www.pblworks.org/; EL Education, https://eleducation.org/; and Internationals Network, https://www.internationalsnetwork.org/). (3) I directly contacted school central office staff, administrators, or teachers in schools that were recommended to me by professionals with expertise in PBL. Of the twelve schools, districts, or states contacted, I was able to conduct interviews and data collection at three schools. Table 1 shows the results of this outreach.

From this purposive sampling, I was able to conduct sufficient interviews with three schools to create in-depth case studies. These cases were therefore a product of both purposive

and convenience sampling. School districts and schools were contacted because of their history of PBL implementation. However, due to the difficulty of obtaining permission to conduct research at different sites, the final cases selected were selected for convenience in that these were the schools where enough teachers were willing to participate in the study. The resulting three cases represent three schools that are all engaged in significant, but different, PBL work. Full profiles of each case will be presented in Chapter Four but I will provide a brief overview here. The names of the schools presented here are pseudonyms.

Table 1

School and district outreach for research

School/district	**Method of contact**	**Result**	**Included**
Forest High School	Principal indicated interest based on research overview sent from a national PBL organization	10 interviews	Yes
Park Middle School	Application for research accepted, principal indicated interest	4 interviews	Yes
Orchard Middle School	Application for research accepted, principal indicated interest	6 interviews	Yes
School D	Application for research accepted, principal indicated interest	2 interviews	No
School E	Email via PBL professional familiar with school	1 interview	No
School F	Application for research accepted, principal indicated interest	0 interviews	No
District III	Application for research rejected	n/a	No
State I	Application for research rejected	n/a	No
District V	Not allowing outside research	n/a	No
District VI	Not allowing outside research	n/a	No
District VII	No response to multiple inquiries	n/a	No
District VIII	No response to multiple inquiries	n/a	No
District IX	No response to multiple inquiries	n/a	No

Forest High School is a small public high school school-of-choice on the West Coast. PBL was part of the instructional program at the school since its foundation in the 1990s. The student population of the school has changed over the years from a predominantly white, upper-class student clientele to a more diverse school in terms of socioeconomic groups, race, and ethnicity. Forest High School has experienced a great deal of transition in the last five years with veteran staff retiring or leaving as well as a recent change of leadership.

Table 2

School demographic information 2022-2023 (https://nces.ed.gov/ccd/schoolsearch/index.asp)

School	Total enroll-ment	American Indian	Asian	Black	Hispanic	Multiple Races	Native Hawaiian	White
Forest High School	356	0%	3.1%	0.3%	62.6%	3.4%	0%	30.6%
Park Middle School	1086	0%	3.4%	3.9%	11.2%	6.2%	0.1%	75.5%
Orchard Middle School	1193	0.5%	2.0%	60.9%	25.5%	3.1%	.2%	7.6%

Table 3

School assessment and learner information 2022 (data accessed from state department of education websites)

School	Disabilities	Economically Disadvantaged	English Learners	Reading Assessments	Math Assessments
Forest High School	Not available	52%	7.9%	Below state average	Below state average
Park Middle School	16.7%	12%	4.4%	Above state average	Above state average
Orchard Middle School	18.2%	100%	6.2%	Below state average	Below state average

Park Middle School is a large public middle school in a large county in the Mid-Atlantic region. PBL became part of Park Middle School's instructional program six years ago as part of a larger district initiative and embraced by the school leadership. The principal at Park Middle School has 22 years of experience as a principal including 10 years at Park Middle School. He emphasizes the teaching practices associated with PBL and encourages teachers to develop learning experiences instead of projects. Park Middle School draws from a student population that is majority White and high-income.

Orchard Middle School is also a large public middle school but in a Southern state. PBL has become a school-wide initiative at Orchard Middle School in the past three years with an experienced principal who was new to the school in the 2019-2020 school year. Prior to that a handful of teachers would do projects but with the current principal, school-wide projects were introduced where all teachers contributed to a themed project. Orchard Middle School is a Title I school with a high percentage of students from economically disadvantaged backgrounds and an increasingly diverse population ethnically and linguistically. Please see Tables 2 and 3 for detailed demographic information for each school. Each of these cases comes from different geographic areas with different student populations and levels of PBL implementation.

Participants

In the three schools, I met with the principals either via phone or video conferencing prior to starting research. The principals then distributed an online survey to their staff in which teachers could indicate their interest in participating in in-depth interviews. In Forest High School, 8 teachers indicated interest in participating in an in-depth interview. In Park Middle School, 6 teachers indicated interest and in Orchard Middle School, 3 staff members indicated interest in being interviewed. As I began conducting interviews I sought additional participants by conducting snowball sampling: at the conclusion of each interview, I asked each teacher if they would recommend other teachers to participate in interviews. I then either directly contacted those teachers or the participants reached out to those teachers on my behalf. In addition to teachers that indicated interest, the principals at all three schools and the assistant principal at Forest High School also participated in interviews. In total, I conducted 10 interviews with staff members at Forest High School, 4 interviews at Park Middle School, and 6 interviews at Orchard Middle School. It should be noted that as a result of school district policy, teachers in Park

Middle School were not eligible for the $100 Amazon gift card offered as an incentive for participation.

Table 4

Demographic information of research participants

School	Gender	Race/ Ethnicity	Age	Experience teaching	Experience at school	Subject
Forest High School	6 Female 3 Male 1 Non-binary	1 Asian 2 Multiple races 1 Hispanic 6 White	34-53 years old	Teaching experience: 6-20 years Administrative experience: 1 year	1-16 years	2 Administrators 1 CTE 2 English 2 Math 1 Science 1 Social Studies 1 World Language
Park Middle School	3 Female 1 Male	4 White	51-58 years old	Teaching experience: 13-35 years Administrative experience: 22 years	5-17 years	1 Administrator 1 Art 1 Science 1 Social Studies
Orchard Middle School	4 Female 2 Male	3 Black 3 White	32-70 years old	Teaching experience: 8-40 years Administrative experience: 14 years	2-14 years	1 Administrator 1 Tech/PBL Coach 3 English 1 Social Studies

In qualitative research, it is important to include participants that offer different interpretations of events. Including "multiple and varied voices," increases the multivocality of my study, offering a more complex understanding of the topic (Tracy, 2010). I was able to successfully conduct maximum variation sampling in that the 20 participants represented a range of content areas and grade levels (Seidman, 2013). In Forest High School and Orchard Middle School, the participants also represented a range of experiences and perspectives about PBL as well as diversity in age, gender, and racial background. Park Middle School teacher participants were more homogeneous in that all teacher participants had been implementing PBL in the same school for five or more years and were white women over the age of 50. See Table 4 for a

description of the demographics of all participants. All teacher names used in the case studies are pseudonyms.

Data collection

Interviews

To explore teacher perceptions about the sources of efficacy related to their PBL implementation, I conducted semi-structured interviews. Semi-structured interviews are ideal for when we want to "learn about things we cannot directly observe" (Patton, 1987 p. 109). In other words, semi-structured interviews allow participants to explain their thinking behind their observable actions. When it comes to understanding the sources of efficacy, it is important to understand how participants interpret sources of information around them such as professional development, feedback from peers and leaders, and student outcomes. Goddard et al. (2000) describes the sources of efficacy (mastery experiences, vicarious experiences, social persuasion, and affective states) as being mediated through cognition at the individual level. The same experience can be perceived differently by different individuals. It is not just the types of information an individual takes in but their method for weighing and valuing each source that creates teacher efficacy (Bandura 1997). Therefore, interviews were ideal for uncovering how teachers are processing the sources of teacher efficacy as it allowed me to probe participants thinking about how they were interpreting different sources of efficacy and how they were weighing the importance of different sources of efficacy.

Prior to the interviews, I asked participants to bring 2-3 artifacts that they felt represented PBL in their classrooms. Teachers brought project examples, project management tools, project templates, and videos describing projects. During the interview elaborated on the artifacts themselves and how the artifacts were used in PBL implementation. These artifacts served two purposes: (1) I was able to establish rapport with the participants as teachers were able to get comfortable sharing a product that they were proud of (Seidman, 2013); and (2) I was able to learn more about the level of PBL implementation by the teacher as they described their projects by listening for key vocabulary and descriptors about PBL (for example, driving questions, sustained inquiry, student voice and choice, community partners). Using artifacts in semi-structured interviews has been shown to provide insights into how teachers think about classroom practices (Goldsmith & Seago, 2011) and student thinking (Luna et al., 2018). The use of artifacts can also help to reduce the bias that comes with self-report (Martinez et al., 2012).

Incorporation of an artifact into the interview allowed me to get an in-depth understanding of how teachers implemented PBL including their planning for and perspectives on student-centered learning.

The remainder of the semi-structured interview focused on questions related first to the sources of teacher self-efficacy aimed at the individual's perspective on their own self-efficacy for PBL implementation and then at the sources of collective efficacy related to the individual's perspective on the collective efficacy of the school for PBL implementation. Participants were asked to rate themselves on a scale of 1 to 10 in terms of PBL implementation. Follow-up questions then included how they arrived at that number. For instance, participants were asked how they get feedback on their projects (social persuasion), how they know if their projects were successful (mastery experiences), and what gives them confidence to continue implementing PBL (various sources of efficacy based on teacher response). The interviews also included questions about how each teacher perceived the extent to which other teachers in their school have implemented PBL in their classrooms (mastery experiences), how teachers get feedback about their PBL implementation at the school (social persuasion), opportunities for teachers to learn about PBL implementation in other schools (vicarious experiences), and the extent to which there is a supportive environment for PBL (affective states). Participants were also asked to rate the level of PBL implementation at the school on a scale from 1 to 10. Questions were designed to elicit responses in which the participants explained how they make decisions about their ability to successfully implement PBL. How they consider their own ability and their peers' ability while making instructional decisions was the focus of any necessary follow-up questions. Interviews with school leaders varied slightly in that questions for school leaders were more focused on collective efficacy regarding PBL implementation at the school and less on self-efficacy as these participants were not implementing PBL themselves. An interview protocol for teachers can be found in Appendix A and for school leaders in Appendix B.

Document analysis

In addition to the semi-structured interviews, I also examined school materials such as the school website, school/district mission and vision statements, school newsletters, media coverage of projects, meeting agendas, and PBL support materials as they related to the sources of efficacy and PBL. In case study research, using documents such as these for evidence helps to corroborate and augment data collected from interviews (Yin, 2018). Document analysis was

conducted to provide context and secondary information, both triangulating data from participant interviews and allowing for richer descriptions of each case study (Bowen, 2009). Documents also provide a counterbalance to self-report in that documents can be a "new and unfiltered perspective" that “often permit going beyond the perspectives of members in the field" (Flick, 2022, p. 382). Caution must also be applied when selecting documents for analysis. As I searched for, identified, and analyzed documents for this study, I continually assessed the materials in terms of authenticity, relevancy, and representativeness (Coffey, 2014). By selecting these school materials in alignment with social cognitive theory, it helped me to both triangulate and crystalize the themes that emerged in my data collection (Tracy, 2010).

To locate these materials, I conducted theoretical sampling which is recommended for document analysis in case studies (Flick, 2022). I sought out materials that would contextualize participants' reflections on sources of efficacy. Materials that described the schools as “PBL schools” for instance, would both triangulate teachers’ descriptions of their schools and serve as an additional source of efficacy in terms of social persuasion. To identify resources that could contribute to the development of theory about sources of collective efficacy for PBL implementation, I conducted multiple online searches using the name of the school and names of teachers that participated in the research. I also followed hyperlinks from Internet sources that related to PBL. For each school I documented my search terms and results, saved a copy of the materials I found, and created a table of each document identified as relevant to the case study. In the table I titled the document, linked to the copy of the document, and recorded the purpose of the document, the purpose of the document for this study, and my analysis of how the document connects to sources of efficacy for the implementation of PBL in each case study (Flick, 2022). See Tables 5, 6 and 7 for a description of documents.

Table 5

Documents collected related to sources of efficacy and PBL for Forest High School

	Type of document	**Source**	**Purpose for study**
Document A1	School website About page stating school mission and vision	Official school website	Contextualizes participants' claims about the school. Reflects how the school publicly describes itself and how that aligns with how the teachers and school leaders describe it

Table 5 (cont'd)

Document A2	Recruitment flier for school	Official school social media page	Contextualizes participants' claims about the school. Reflects how the school publicly describes itself and how that aligns with how the teachers and school leaders describe it
Document A3	School Wikipedia page	Result of online search, crowd-sourced online encyclopedia	Contextualizes participants' claims about the school. Shows how school is perceived by the public, not just how school self-describes.
Document A4	Critical Friends Group protocol	Provided by school leader	Demonstrates routines and procedures in place to support PBL at the school level. Reinforces statements made by participants about participating in Critical Friends Groups. Provides details about the process not discussed during the interviews.
Document A5	Project template	Provided by school leader	This template demonstrates the school expectations for teachers for PBL implementation. In addition to setting expectations, this template is also a teaching document in that it supports teachers new to PBL. It contains key elements that teachers mentioned in their interviews, contextualizing, and triangulating their statements.
Document A6	Caroline Blog Post	Result of online search, teacher's blog	This provides insights into how this teacher thinks about PBL in a format other than an interview with a researcher. It provides triangulation for how this teacher shared her perspective about PBL. It is an independent artifact of her sense of self-efficacy
Document A7	Caroline Blog About Me Page	Result of online search, teacher's blog	This provides insights into how this teacher thinks about PBL in a format other than an interview with a researcher. It provides triangulation for how this teacher shared her perspective about PBL. It is an independent artifact of her sense of self-efficacy

Table 5 (cont'd)

Document A8	Newspaper story about project	Result of online search, local media website	This serves as an independent source describing a high quality PBL unit completed by a Forest High School teacher. This provides context for this participant's responses and triangulates self-report data.
Document A9	Lucy Blog Post	Result of online search, teacher's blog	This provides insights into how this teacher thinks about PBL in a format other than an interview with a researcher. It provides triangulation for how this teacher shared her perspective about PBL. It is an independent artifact of her sense of self-efficacy
Document A10	Lucy Blog About Me Page	Result of online search, teacher's blog	This provides insights into how teachers think about PBL in a format other than an interview with a researcher. It provides triangulation for how this teacher shared her perspective about PBL. It is an independent artifact of her sense of self-efficacy

Table 6

Documents collected related to sources of efficacy and PBL for Park Middle School

	Type of document	**Source**	**Purpose for study**
Document B1	School website "We are a PBL Design School" page	Official school website	Contextualizes participants' claims about the school. Reflects how the school publicly describes itself and how that aligns with how the teachers and school leaders describe it
Document B2	District website "Deeper Learning"	Official district website	Contextualizes the extent to which PBL implementation at the school aligns with district priorities.
Document B3	Newsletter A	Provided by school leader	This document validates the school leader interview in which he discusses sharing PBL highlights with parents and staff. This example highlights a specific project.

Table 6 (cont'd)

Document B4	Newsletter B	Provided by school leader	This document validates the school leader interview in which he discusses sharing PBL highlights with parents and staff. This example describes the main features of PBL
Document B5	Newsletter C	Provided by school leader	This document validates the school leader interview in which he discusses sharing PBL highlights with parents and staff. This example highlights a specific project.
Document B6	Newsletter D	Provided by school leader	This document validates the school leader interview in which he discusses sharing PBL highlights with parents and staff. This example highlights a visit from another school and a blog post about PBL by a PBL expert.
Document B7	Video about project posted on school district's website	Provided by participant	One of the interviewees sent me this video as an example of a project she did that got recognition in the county.
Document B8	Press release from school district about project	Linked from official district website	This is an example of the school district recognizing a PBL as positive news. This piece describes a project that was shared by the interviewee as an example of PBL in her classroom. The school district also recognizes it as an example of PBL.
Document B9	Newspaper article about project	Local media website	This serves to triangulate data from the participants and the school district as it is a third party publication.
Document B10	Project website	Provided by participant	This is an example of how a teacher scaffolds and manages a project, in this case to support student research. This is also an example of a resource a teacher created that all science teachers in one grade level in the school district will use.

Table 7

Documents collected related to sources of efficacy and PBL for Orchard Middle School

	Type of document	**Source**	**Purpose for study**
Document C1	Executive Summary of School	Result of online search	This document contextualizes participant claims about the school and the focus on PBL. Reflects how the principal aligns PBL with the goals of the school.
Document C2	Press Release	Result of online search	This document specifics professional learning opportunities provided by the district and explains the goals of the program and why it was recognized.
Document C3	Blog post on an educational site authored by a district leader	Result of online search	This article provides evidence that PBL is a focus for Orchard Middle School and the school district. It provides some details about how Orchard Middle School is implementing PBL and the challenges it is facing which also supports issues raised by staff members from Orchard Middle School.
Document C4	Orchard Middle School Home Page	Official school website	Contextualizes participants' claims about the school. Reflects how the school publicly describes itself and how that aligns with how the teachers and school leaders describe it
Document C5	Save the date flyer	Linked from official school website	Inclusion of the student showcase on the Save the Date flyer shows that this event does happen and that it is important to the school (because it is included alongside other school events like Open House and PTSA meetings).
Document C6	Project Overview	Provided by participant	This project overview allowed me to see the details of the school-wide PBL that was mentioned by participants in the study. This reinforced the school-wide messaging for PBL at Orchard Middle School as well as evidence of the supports put in place to guide teachers in their implementation.

Table 7 (cont'd)

Document C7	Fighting Fake News Project Planner	Provided by participant	Serves as evidence of teachers implementing PBL beyond the school-wide PBL. Provides insight into how a teacher plans PBL and to what extent they consider the high-quality PBL design elements and teaching practices.
Document C8	PLC Agenda for Social Studies Department	Provided by participant	This document serves as evidence that PBL is discussed and supported during PLC meetings. In this example there is also evidence of oversight for PBL in that the PLC lead announces walk-throughs to specifically support the PBL project
Document C9	Chart mapping school initiatives	Result of online search	This provides further evidence that Orchard Middle School has been designated a PBL school and that the school district supports that
Document C10	Social Studies PBL/STEM Planner	Provided by participant	Serves as evidence of teachers implementing PBL beyond the school-wide PBL. Provides insight into how a teacher plans PBL and to what extent they consider the high-quality PBL design elements and teaching practices.

Positionality

It is important to note my positionality in this study as my cultural background, my educational experiences and beliefs, and even my role as a mother influence my research approach (Bourke, 2014). I am a middle-class, middle-aged, white, straight, cisgender, mother of two. In addition to being a PhD student, during most of this research, I was a Technology Integration Specialist in a middle school that was in the process of increasing implementation of PBL. In my career as a social studies teacher first and then an educational technology coach, and as a mother of children that have experienced both PBL and teacher-driven instruction, I have come to deeply believe in the value of student-centered pedagogical practices. I have designed, facilitated, and led professional development about PBL. I have also conducted prior research about how teaching a summer learning course that implemented student-centered learning

influenced teachers' use of student-centered learning during the traditional school year. These experiences as a practitioner and scholar of PBL shape how I approached this study.

This positionality, as a believer in PBL, was important for me to acknowledge from the very beginning of this study. Even as I developed my research questions and methods, I sought to recognize how my positionality might have influenced my thinking. I used analytic memos as a way to reflect on my positionality and consider how it may have influenced my decisions as I selected schools and participants. In addition to analytic memos, I met regularly with my dissertation committee chair to share my process and progress. During the data analysis portion of this study, I continued to meet and review my coding process with my dissertation committee chair as well as other members of my committee and colleagues in order to gain different perspectives on what themes I was seeing in the data. Finally, I strove to find counterexamples and negative examples in the study to mitigate how my lived experiences may have been impacting my data analysis.

Data analysis

Open coding

Recordings from each interview were sent to a transcription company (https://otter.ai/home) and then reviewed for accuracy and edited from beginning to end. While reviewing the transcriptions, I kept analytic memos about my initial thoughts about the interviews and potential codes. After reviewing the transcripts, I further familiarized myself with the data by conducting open coding. Specifically, I used structural coding which involves using a phrase to describe responses to segments of the research question (Saldaña, 2016, p.98). These codes were created from the data and were not decided *a priori*. This stage was critical for me to notice what the participants were saying without imposing the limits of the structure of the established four sources of efficacy theorized by Bandura (1997). Braun and Clarke (2006) recommend this step before determining themes in order to see the diversity of the data as presented. After the first round of coding, I identified codes that were similar. For instance, initially being a coach, being a mentor, or being invited to speak at a conference were all separate codes. Combining these into one code "teaching others about PBL" drew together common elements into one code. Similarly, some teachers talked about problem-based learning and others about project-based language learning. Each of these were exploring the idea that PBL looks different in different content areas so the new code became "content area

differences." By using this new code, I was then able to connect similar ideas from the fine arts and career and technical education teachers. In some cases where tone, pauses, or hesitation added important information to the words being spoken, I annotated quotes with this additional information (Seidman, 2013). I also conducted iterative coding, identifying codes across interviews and returning to prior transcriptions to re-code passages. Finally, I organized some of the codes into categories such as PBL supports, school descriptors, and elements of high quality PBL.

Thematic analysis

For the second round of coding, I conducted concept coding. Concept coding assigns meso or macro levels of meaning to the data (Saldaña, 2016). These codes related to the identified sources of teacher efficacy: mastery experiences, vicarious experiences, social persuasion, and affective states for both self-efficacy and collective efficacy. Prior to coding the data, and using prior research, I created a list of anticipated participant responses for each coding category. For instance, for mastery experiences that inform self-efficacy, I expected to hear teachers talking about projects they've done, workshops they attended, materials they developed, and their role as a model to others in which they recognized their own skills. As I coded the data, I reflected on and revised this list. I coded passages of the transcripts using these codes and added new codes to the list as I encountered data that did not fit my predicted responses. I also removed codes that I had predicted based on prior research but did not surface in the data. For instance, I anticipated that teachers might discuss watching videos of other teachers implementing PBL as a vicarious experience that informed their self-efficacy. This was not mentioned by any teachers. Instead, teachers mentioned reviewing access to other teachers' learning management systems, following other PBL teachers on social media, and using search engines to find project ideas. These were all modes of vicarious experiences I had not predicted prior to conducting the interviews.

In addition to grounding these codes in the data, I continually returned to teacher efficacy research and sought prior studies that defined sources of teacher efficacy in similar ways to how I was coding responses. Sometimes these citations were grounded in theoretical writings. For instance, I referred to how Bandura described the sources of teacher efficacy as justification for how I was defining codes. I was not always able to find prior research to justify my coding choices. Due to the lack of qualitative research on collective efficacy, it was difficult to find

justification for how I defined a collective mastery experience for PBL implementation. A great deal of research about collective efficacy has been quantitative (Klassen et al., 2011) and defines mastery experiences as student achievement on standardized assessments. When considering if their school can successfully implement PBL, teachers may or may not use student achievement information to decide this. Alternatively, they may cite examples of projects being implemented in the school. In PBL-related research about self-efficacy mastery experiences, prior research has identified sources of mastery experiences as those related to acquiring knowledge and skills about PBL during professional development (Bumen, 2009; Mirici & Uzel, 2019). In a study of a problem-based science unit (a practice very similar to project-based learning), Hodges et al., (2016) defined mastery experiences as teachers implementing the 8-week unit. I therefore applied this line of thinking for self-efficacy to the entire school to define mastery experiences for collective efficacy.

As codes changed, expanded, and narrowed, I frequently returned to coded passages to determine if the code I applied was consistent with how the code was applied to other passages (Braun & Clarke, 2006). I also began to look for themes in the data that were either central to the sources of teacher efficacy or encompassed ideas across multiple sources of efficacy. These themes captured ideas from multiple codes. “Learning with and from each other” is an example of a code that crosses many different sources of efficacy both for the self and for the school (collective). Participants discussed how being a trainer increased their confidence in their knowledge about PBL (mastery experience). Being asked to be a trainer also raised their efficacy because of the feedback from school leaders in asking them to train another teacher (social persuasion). Teachers being trained also discussed being taught by their peers as both a role model for their own implementation (vicarious experiences) as well as evidence that their school was good at PBL (mastery experiences, collective efficacy). I will go into more detail about these themes that cross multiple sources of efficacy in my findings section. See Table 8 and 9 for explanation and examples of coding choices.

Table 8

Self-Efficacy codes, reasoning, and examples

Sources of self-efficacy	Code and description	Reasoning	Example
Mastery experiences	Doing PBL - participants provide examples of projects they are implementing in their class (past and present) that exhibit qualities of high quality PBL implementation. This also includes artifacts that document these projects.	Hodges et al., (2016) defined mastery experiences as teachers implementing the 8 week unit	"so it's, it's, it's a lot at first, but once you start to get into it, and you understand, you know how to set up the rubrics and how to kind of guide the kids. It makes it flow." (Leona, Orchard Middle School)
Mastery experiences	Seeing the results of PBL - participants discuss student outcomes from PBL that increase their sense of mastery of PBL. These skills usually encompass both subject matter learning and interpersonal and intrapersonal skills.	"Scholars who seek to measure mastery experience should instead ask teachers to focus on the outcomes of their performances—the direct experiences that teachers reflect on in evaluating the extent to which they have achieved their goals" (Morris et al., 2017, p. 805)	"So I think that has improved the kids' connection with the curriculum, so they're more interested in it, because I'm connecting things more to things that interest them. So that improves engagement, and therefore improves learning." (Sarah, Park Middle School)
Mastery experiences	Experience doing PBL - participants also discussed how teaching PBL over time makes teaching PBL easier.	Bandura (1997) discusses how the assessment of task difficulty influences efficacy beliefs. That teachers talked about how after completing a PBL project they felt more comfortable to conduct that PBL again indicates that experience doing PBL provides a mastery experience.	"I found that I got better and better at it, over the years." (Betty, Orchard Middle School)

Table 8 (cont'd)

Mastery experiences	Learning about PBL - often referred to as "cognitive mastery" participants talked about how learning about PBL through formal professional development or informal self-guided learning helped them feel more confident in their implementation of PBL	"mastery experiences should be associated with ongoing aligned professional development, positive feedback, and coaching" (Thornton et al., 2020)	"that early learning was so impactful for me that I'm still using a lot of those practices, I still reference a lot of the resources from that time" (Caroline, Forest High School)
Mastery experiences	Teaching others about PBL - participants shared that by being asked to teach others about PBL they recognized their own mastery at PBL which increased their confidence. Participants provided examples where they were able to help others implement PBL.	"that a fifth source of self-efficacy, invitations, is for some groups a more important source of information than mastery experiences. Invitations are the messages that we send to ourselves (and others) that indicate how able and valuable we feel that we (and others) are" (Ross & Bruce, 2007, p. 59)	"being trained, and then training others, I think gave me more confidence" (Angie, Forest High School)
Vicarious experiences	Peer models (mentoring)- participants talked about the influence another teacher had on their self-efficacy for PBL	Versland & Erickson (2017) described the modeling from other teachers as a source of vicarious experiences for the teachers in their study.	"I just kind of fell under his wings. And he said 'Oh, no, this is what we're doing. We're doing PBL.' And so from the get-go, I've been a PBL teacher" (Angie, Forest High School)
Vicarious experiences	Patchwork of PBL models - participants referred to finding PBL models from a variety of sources in addition to peers. For instance, participants talked about finding example projects online, at conferences, or in a local database.	While prior research did not use this exact term, these are examples of indirect PBL modeling. In referencing these PBL models, teachers discussed using these to widen their options for vicarious experiences.	"I follow certain math people and they present really interesting math problems, and some are very unique. And they allow for rich conversations and interesting ways to present problems (Jim, Forest High School)

Table 8 (cont'd)

Vicarious experiences	Comparing PBL implementation: participants talked about recognizing where their own PBL implementation was either superior to peer examples or was lacking when compared the peer examples.	Bandura (1997) explains that there is often no absolute measure of adequacy so people must make decisions about their abilities in relation to others. Usher (2009) also considered comparing one's own ability to others as a vicarious experience although cautioned that this also relates to self-concept as well as self-efficacy.	"The first year she [a colleague] did the project… She won a big award. So that's the kind of thing you're always thinking, like, how can I get my students' project to be public?" (Katarina, School A)
Social persuasion	Student feedback - teachers share that they solicit and are open to advice from students about what is working in their projects and where projects need refinement	Very little prior research points to the role feedback from students plays in self-efficacy, however in this study, student feedback seemed to provide feedback that informed teachers' beliefs that they had the capabilities to implement PBL which aligns with Bandura's definition of social persuasion (Bandura, 1997)	"The students? You know, yes. Because I want to make sure I have buy in. So yeah, I mean, I'm always trying to think of things that I can get them to want to do this. So they're, I mean, they're probably at the front of it all. Right. What might be meaningful for them?" (Angie, Forest High School)
Social persuasion	Feedback from peers - participants share how getting feedback about their PBL implementation from their peers in the form of PLC planning, peer observation, or informal feedback is helpful and increases their self-efficacy for PBL implementation.	In addition to direct feedback from peers, teachers also talked about "messages" (Morris et al., 2017) they received that indicated others thought of them as PBL experts.	"It is good to know that other people want to come and see what we're doing. Especially if they're just starting out on the PBL train, as I call it." (Helen, Park Middle School)

Table 8 (cont'd)

Social persuasion	Feedback from leaders - participants share how getting feedback about their PBL implementation from coaches or administrators is helpful and increases their self-efficacy for PBL implementation	Bandura (1997) specifically addresses the need for social persuasion to come from a knowledgeable and credible source. Teachers in this study referred to their school leaders as knowledgeable and credible in terms of PBL.	"You probably need to ask my principal that because he would he would rate me 300 times higher than I rate myself (Helen, Park Middle School)
Social persuasion	Official acknowledgement - participants gave examples where the project their students had worked on or they, themselves, were recognized by the school, the school division, or an outside organization as award-winning. Teachers talked about the impact this had on their efficacy.	Bandura (1997) specifies that "supposedly objective indicants of capabilities" boost efficacy (p. 104). Being given an award, title, or recognition related to PBL served as a source of social persuasion.	"I was actually awarded from the STEM person for my work with the PBL, getting it going in the school" (Dan, Orchard Middle School)
Affective states	Enjoyment of implementing PBL - participants enthusiastically talked about PBL and how much fun it was or how good it felt to implement PBL. Focus here is on overall enjoyment and good feelings about teaching PBL.	Prior research has considered positive feelings associated with instruction as evidence of affective states (Snyder & Fisk, 2016; Gabriele & Joram, 2007)	"That was a blast. Kids were like, 'Can we do this again?'" (Helen, Park Middle School)
Affective states	Alignment of PBL with own skills and beliefs- participants also shared that part of what felt good about PBL was how it aligned with their beliefs about their own teaching style. Focus here is on how the pedagogy of PBL provided consonance with their personal beliefs about teaching.	While self-efficacy research and current measures do not specifically describe consonance of personal beliefs with pedagogy, the centeredness that comes from this consonance indicated low-stress and positive emotional states.	"I think I'm more student-centered. You know, I never was a sage on the stage teacher, you know, that was never my style. So it [PBL] fit very well for me." (Sarah, Park Middle School)

Table 9

Collective efficacy themes, related codes and sources, and examples

Theme	Related sources of collective efficacy and self-efficacy	Related codes	Example
"We are a PBL school" importance of clear, school-wide messaging	Collective efficacy: Mastery experiences, social persuasion, affective states	We are a PBL school - participants describe the school as a PBL school, a "fully implemented" PBL school or other phrases that assert PBL is an established focus of the school	"we're the one of the very first PBL schools in the country" (Lucy, Forest High School)
		Doing PBL as a school - participants describe examples of PBL happening in their school, emphasis here is on the wide-spread nature of PBL, not on explaining projects in detail	"a lot of teachers are connecting their projects to things that are happening in the city near us on a day to day basis, with their environmental science classes, with our history classes, all the projects" (Arthur, Forest High School)
		Student outcomes school-wide - teachers sharing examples of students having skills and knowledge as a result of PBL being implemented at the school level	"teaching them how to speak in front of a big group of people or, you know, be independent, when given just an open amount of time to work, is one of the things that we do. And it's part of an expectation of being a project based learning school." (Katarina, Forest High School)
		Whole-staff messaging about PBL - participants discuss giving or receiving clear messages about expectations for PBL implementation	"they're [administration] united in, 'This is the way our school is. And this is how we expect teachers to be'" (Sarah, Park Middle School)

Table 9 (cont'd)

Learning with and from each other	Collective efficacy: Mastery experiences, social persuasion, affective states	Learning with and from each other - participants provide examples of the whole school being trained together or in similar ways, as well as examples of teachers teaching each other about PBL, emphasis here is on learning happening school-wide instead of specific PLCs or the impact school-wide instead of the impact on individual teachers	"people at our school were going, 'Okay, if you're working on your driving question, well, then I can come to you, and you can come to me,'" (Helen, Park Middle School)
		Additional relevant collective efficacy codes: Supportive, trusting culture or positive relationships among staff	
School-wide PLC routines and procedures	Collective efficacy: Mastery experiences, social persuasion, affective states	School-wide PLC routines and procedures - participants refer to structures like regular PLC meetings or protocols like Critical Friends and how the feedback and collaboration via these structures supports their PBL implementation	"We can really, every week, we can talk about like, if we're implementing a PBL, we can talk about where we are at and what we need to get done. So it's, I like it that way." (Lou, Orchard Middle School)
		Additional relevant collective efficacy codes: Doing PBL as a school, Whole-staff messaging about PBL, Supportive, trusting culture, Positive relationships among staff	

Table 9 (cont'd)

Supportive, trusting culture	Affective states	Supportive, trusting culture - participants described high levels of trust either between teachers and administrators or among staff members and how this trust helped them feel comfortable with their PBL implementation	"But just knowing that all of us are in the same boat, right that we and we will all help one another. That's the beauty of this school." (Angie, Forest High School)
		Positive relationships among staff - teachers share that they are close with each "like a family," and are all willing to give and accept feedback, and are excited about their work	"I find my school is very supportive. I find that teachers between each other are very supportive. It's a very kind staff" (Bari, Orchard Middle School)
		Positive relationships between staff and students - teachers share that the school community is very trusting, that students are cared for and feel safe	"I would say that there's a lot of trust involved, right. So like, trust with the teachers, trust with the students" (Theresa, Park High School)
		Additional relevant codes: Warm and trusting administrator	
Warm, supportive (informed) administrators	Collective efficacy: Social persuasion, affective states	Warm, supportive (informed) administrators - participants described overall positive sentiments about their principals including how the principals supported risk-taking and growth instead of demanding PBL implementation, that their principals were knowledgeable	"Whereas, you know, when, [administrators] by kind of letting us take it one step at a time, it, it gave that level of comfort where people could become confident" (Sarah, Park Middle School)
		Additional code relevant to collective efficacy: Whole-school PBL messaging, supportive, trusting culture	

Credibility and trustworthiness

To establish content validity for my analysis process, I met with three colleagues that research efficacy and motivation. These colleagues reviewed my codebook and sample codes. We discussed how my codes aligned with current research on collective efficacy and identified any areas that veered too far from prior studies. Specifically, we discussed how well different codes fit into the four different sources of self- and collective efficacy. Particular attention was given to the sources of collective efficacy as there is limited prior qualitative research related to the sources of collective efficacy (Klassen et al., 2011; Zhou, 2019). In addition, our discussions also addressed situations where more than one code might be applied to participant responses and document analysis. Each colleague also coded a sample of quotes to determine if there was common understanding about how the codes were applied to specific quotes. With both colleagues, there were instances of disagreement. We then reevaluated codes and in some cases readjusted the codes and in other cases, double-coded quotes or split codes to more accurately align with codes.

In addition to working with other researchers, I solicited member reflections. Member reflections "provide opportunities for additional data and elaboration that will enhance the credibility of the emerging analysis" (Tracy, 2010). As I began to move past coding and into thematic analysis, I reached out to all teacher participants and asked for their feedback on three themes that had emerged from the data for each case. In addition to seeking their opinion on the validity of these themes, I also asked teacher participants to rank four specific sources of collective efficacy in terms of how influential each factor was in their PBL implementation. Of the 15 participants contacted, 10 participants responded. In addition, I sent a draft of each case study to the respective school leaders. Each school leader was given an opportunity to review and share feedback. These responses are incorporated into my findings and provide additional multivocality adding to the credibility of my findings.

CHAPTER FOUR: RESULTS

In this chapter I will present the three case studies: Forest High School, Park Middle School, and Orchard Middle School. Each case study has five sections: a profile, collective efficacy themes, self-efficacy themes, challenges to self- and collective efficacy, and a summary.

Profile of Forest High School

Forest High School is a small, public, charter high school located on the West Coast that was founded over twenty years ago on the principles of project-based learning in a technology-rich environment. The founders sought to design a high school that would ensure students were "meeting the normal high school expectations, but also having an explicit development of the kinds of then-late 20th century skills that students would need for the workforce" as described by Alan, one of the administrators. Forest High School has a long-established reputation of implementing PBL in all courses and this is a key component of recruitment materials for students (Document A1 and A2). Teachers at Forest High School had relatively high self-efficacy for PBL implementation. When asked to rank themselves on a scale from 1 to 10, with 1 indicating that they are just starting to learn about PBL and 10 indicating that they are an award-winning PBL teacher, responses ranged from a 5 to a 10 (mean = 7.5, n=9). Forest High School has an enrollment of under 400 students and is considered an open enrollment school. Demographics of the school have changed since its foundation, shifting from a majority white, high-income student population to a racially diverse school with over 50% of the students eligible for free and reduced lunch. Additionally, the percentage of English Language learners has risen at Forest High School in recent years. See Tables 2 and 3 for full demographic details. Recently, Forest High School has had significant transition in leadership with two new administrators starting in 2022-2023, the school year in which interviews were collected. During the COVID-19 pandemic and the ensuing years of online learning, hybrid learning, and the return to in-person learning, Forest High School also hired several new staff members in response to teacher retirements and other staffing changes. As several participants shared in their interviews, Forest High School is in a period of reflection and re-examination. One of the teachers, Caroline, described, "We're kind of in an identity shift right now. We're just starting this work around kind of revamping and re-ideating our vision as a school." The school is revisiting its mission and reevaluating how PBL fits in with the changing landscape of their school and the larger culture of their community.

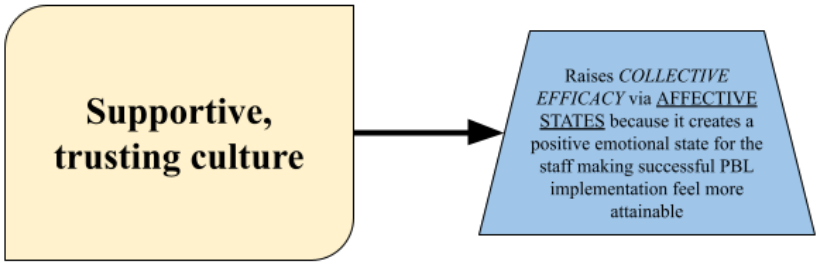
Themes related to sources of collective efficacy for PBL implementation at Forest High School

There are several ways in which the culture of Forest High School supported the four sources of collective efficacy for PBL implementation. Some of the themes that emerged from the interviews and document analysis connected to multiple sources of collective efficacy (see Table 9 for examples of codes and sample quotes). In the following section I will explore each theme and identify the source or sources of collective efficacy related to that theme.

A supportive, trusting culture

Figure 1

Relationship of theme "A supportive, trusting culture" with sources collective efficacy for Forest High School



One source of collective efficacy is positive affective states. Organizations that have a positive emotional state like support and care feel more successful at tasks they are undertaking compared to organizations with high levels of stress and pressure (Goddard et al., 2000). At Forest High School there was a strong sense of a supportive, trusting culture that created a positive affective state for teachers in terms of their PBL implementation. There were three ways teachers talked about how the supportive, trusting culture created positivity at their school. Teachers talked about (1) the school community as a "family," (2) the high level of trust among teachers and students, and (3) the high level of trust between the teachers and the administrators. In this section I will provide examples of how the teachers talked about the supportive, trusting culture at Forest High School and how this facilitated positive affective states that enhance collective efficacy for PBL implementation.

Teachers at Forest High School felt very strongly that the supportive, trusting culture at their school was an important reason that they were able to implement PBL as a school. Forest High School teachers emphasized the importance of the positive relationships among the

teachers. Angie explained, “You know, we're very, almost like family-oriented. So you know, we're checking in on each other.” Several teachers used the term “family” to describe the culture of the school. Katarina reiterated this collegial atmosphere and talked about how this supportive and trusting culture helps when learning something new like PBL. “Having colleagues that you know, are happy to have you bounce an idea off of them, I think is crucial for anybody, any adult teaching staff attempting project-based learning.” The supporting, trusting culture among the staff creates a positive emotional state when it comes to PBL implementation, allowing the teachers to feel more comfortable and confident when implementing PBL.

This supporting, trusting culture extended to teachers’ relationships with students and relationships among the students. When asked to describe the school, Theresa said, “I would say that there's a lot of trust involved, right. So like, trust with the teachers, trust with the students.” Katarina explained that this trust is an integral part of the culture at Forest High School. “We have, like a saying, I guess, trust, respect and responsibility. And so those are the tenets that we kind of all abide by.” In addition to the descriptions from teachers about how the students feel supported and involved in the school community, the school’s vision statement makes this explicit, “To build relationships that are collaborative, compassionate, sensitive, culturally inclusive, personal, respectful, trusting, and develop self-management and emotional intelligence" (Document 1A). This positive relationship among staff and students helps to foster a positive emotional state that allows PBL to flourish. Teachers feel able to implement projects with students that they trust and students that trust them. “When there is no trust, PBL really goes downhill” (Lucy). Other teachers talked about how by having a supportive, trusting culture, students are more willing to take risks and show initiative during projects, “students will be okay to get something wrong, try something, go out, you know, go outside their safety zone” (Jim). When I reached back out to participants to confirm the importance of this culture of trust for PBL to be confidently implemented, Katarina explained via email, “In order for students to be at their best in the classroom they need to be vulnerable. PBL requires students to think in a different way and often rely on each other for the learning that happens.” This flow of trust between students and teachers fosters a positive emotional state that signals to teachers that they are capable of implementing successful PBL units.

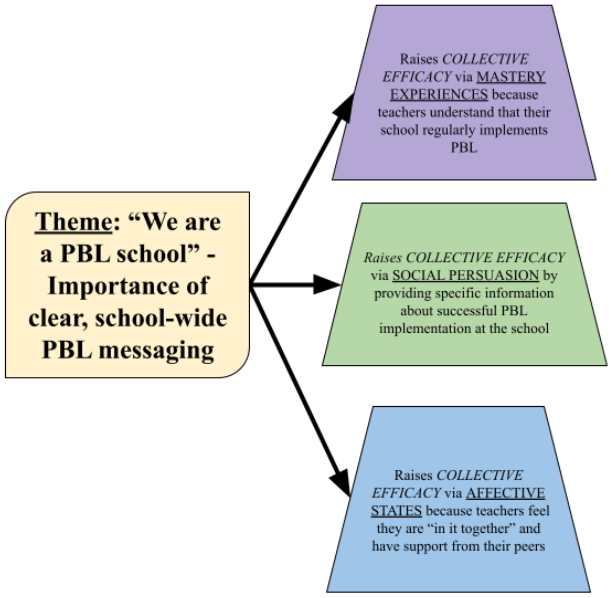
In addition to the supportive, trusting culture among the teachers and with the students, teachers at Forest High School also expressed how their administrators served as a source of

support and trust. Teachers at Forest High School heaped praise on their principals: “they're amazing, they're great”; “I love my administration. I think they're great"; "absolutely hands down favorite.” Katrina specified how the support and trust from administrators influences the collective efficacy for PBL implementation at Forest High School, “When someone doesn't feel like the admin are gonna come in and be punitive or criticize, they're much more open to taking a risk. You know, saying ‘I'm gonna go for it and do this project.’” This general atmosphere, teacher after teacher affectionately speaking of their principals, signaled an overall positive emotional state when it came to PBL implementation, enhancing teachers' sense of collective efficacy. One of the administrators at Forest High School also shared how he wants his teachers to know they're not going to be a “PBL master right away, tomorrow, it’s going to be a process.” This message of understanding – that instructional approaches like PBL take time to master – fosters a sense of ease in the teachers rather than one of high stress. The supportive, trusting culture creates and supports a positive emotional state that develops collective efficacy for PBL implementation.

“We are a PBL school” and the importance of clear, school-wide PBL messaging

Figure 2

Relationship of theme “‘We are a PBL school’ - Importance of clear, school-wide PBL messaging” with sources of collective efficacy for Forest High School



A second theme at Forest High School was that teachers consistently described their school as a “PBL school.” This theme relates to three sources of collective efficacy: mastery

experiences, social persuasion, and affective states (see Figure 2). In this section I will provide examples of how teachers spoke of these different sources of collective efficacy in terms of PBL implementation.

Bandura (1997) considered mastery experiences to be a strong source of collective efficacy. Mastery experiences that support collective efficacy are those that signal to teachers that their school is successful at PBL implementation as an entire staff. One indicator for teachers that their school is successful at PBL implementation is that the school is recognized for being a PBL school and that the staff, parents, and community all refer to it as a PBL school. Teachers from Forest High School exhibited this strong sense of collective efficacy for their school by embracing this label as a "PBL school." All participants from Forest High School said "We are a PBL school" when asked to describe their school. The administrators and teachers talked about the school's origin and its connection to PBL: "we're the one of the very first PBL schools in the country" (Lucy), "we are a PBL school" (Theresa), "it's been over 20 years, and there are hundreds of schools around the world that have adopted the Forest High School model, which is project-based learning" (Caroline). These comments are substantiated in several of the documents analyzed for this study. The school's mission statement (Document A1) describes it as project-based as does its student recruitment flyer (Document A2). Even the wikipedia page for Forest High School mentions the use of project-based learning in all classrooms (Document A3). Teachers discussed these labels as evidence that the school was already implementing PBL successfully as part of its day-to-day operations. Past success as a PBL school served as a mastery experience for teachers at Forest High School.

While embracing the label of their school as a PBL school offers some indication of mastery experiences, being able to cite examples of projects being done around the school further creates mastery experiences for collective efficacy. Collective efficacy for PBL implementation means that teachers believe that the school as a whole is successfully implementing PBL. Teachers knowing that other teachers at their school are regularly implementing PBL serves as mastery experiences for collective efficacy for PBL implementation. At Forest High School, in addition to naming their school as a PBL school, teachers also spoke specifically about projects being enacted across the school. This ability to describe PBL implementation happening widely and repeatedly across the school enhanced teachers' sense of collective efficacy for PBL implementation. For instance, Theresa, who was

new to Forest High School, shared, “there are some classes that are really cool that are here that are very project-based… There are other classes like history classes and government classes where they actually like, participate in things in the government.” This evidence that several teachers are implementing PBL provides Theresa with mastery experiences that her school is engaged in PBL on a consistent basis. By knowing that many teachers are implementing PBL and knowing specifics about those projects indicates to Theresa that her school is successfully implementing PBL. The principal of Forest High School also provided examples of PBL happening around the school, “a lot of teachers are connecting their projects to things that are happening in the city near us on a day-to-day basis, with their environmental science classes, with our history classes, all the projects.” He was clear that the PBL was not just happening in one or two classrooms, but that PBL was widespread practice. This knowledge of multiple teachers implementing PBL served as a mastery experiences for the collective efficacy for the entire school.

In order for teachers to interpret information as examples of mastery experiences, they must have knowledge of what successful PBL implementation looks like in addition to being able to experience it. Being able to name your school as a PBL school and provide evidence that PBL is being implemented widely provides a general sense of collective efficacy that your school implements PBL but part of what makes this possible is a clear understanding of the expectations of PBL at Forest High School. At Forest High School, very clear expectations were set about what successful PBL implementation looks like and how often PBL should be implemented. Therefore, part of the clarity teachers at Forest High School expressed about mastery experiences for the school implementing PBL is directly related to the “importance of clear, school-wide PBL messaging.” In addition to helping to clarify mastery experiences, these clear expectations also served as social persuasion for teachers. Setting clear expectations encouraged teachers to continue their PBL implementation. The principal at Forest High School discussed how this was one of his primary goals for the school to make sure there was “clear and consistent communication with all of our stakeholders” (Arthur). This messaging was then supported with project planning templates (Document A5) that outlined the expectations for projects as well as a rubric teachers referred to as “the Six A’s rubric.” The result was that many teachers felt they “just know what our school kind of expects” (Angie). In addition to clearly communicating what PBL implementation looks like, principals at Forest High School were

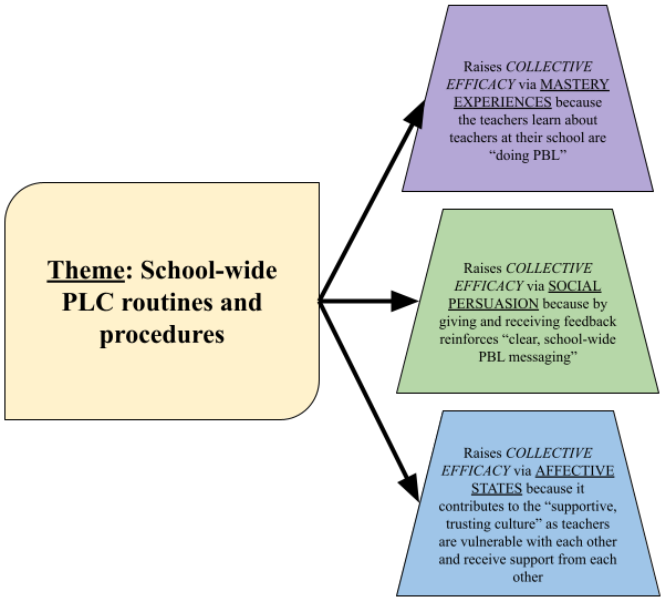
clear in what kind of student outcomes they wanted to see. Forest High School has identified student outcomes that are listed on the school's webpage (Knowledge & Thinking, Oral Communication, Collaboration, Written Communication, Agency, Document A1). In addition to serving mastery experiences, knowing what kinds of student outcomes should be a part of PBL implementation and what PBL should look like also serves as a source of social persuasion for PBL implementation collective efficacy by giving teachers clear messages about the school's success implementing PBL.

Finally, having a clear, consistent message about being a PBL school also supports positive affective states in that teachers can feel confident about not just about what is expected of them, but what all the teachers around them are doing and are expected to do. Caroline shared in a follow-up email, "When I feel like we are all in it together, it's more manageable to incorporate a deeper level of learning for students." This widespread knowledge of projects being implemented across the school both serves as mastery experiences and also as further support for positive affective states.

School-wide PLC routines and procedures

Figure 3

Relationship of theme "School-wide PLC routines and protocols" with sources of collective efficacy for Forest High School



In addition to having clear, consistent messaging about PBL implementation, structures that give teachers a chance to provide feedback to each other about PBL implementation

supported collective efficacy at Forest High School. The use of school-wide PLC routines and procedures is effective because it develops multiple sources of collective efficacy (see Figure 3). In this section I will provide details about how the staff at Forest High School discussed school-wide PLC routines and how they support mastery experiences, social persuasion, and positive affective states.

Forest High School uses a Critical Friends protocol (Document A4) in their PLCs. The Critical Friends protocol used at Forest begins with a teacher presenting an overview of a project they are planning with a particular lens on what parts of the project with which they might be struggling. The rest of the group listens to the presenting teacher, then offers comments on strengths, room for improvement, or ideas for next steps. The protocol finishes with the original teacher offering a response and a thank you. Several teachers at Forest High School mentioned the importance of this structure to their confidence in implementing PBL.

Social persuasion supports efficacy by providing clear and actionable feedback from a respected source (Bandura, 1997). The Critical Friends protocol provides social persuasion for collective efficacy in regards to PBL implementation. During the Critical Friends protocol, the teachers refer to school-wide documents that specify how PBL should be implemented at Forest High School. For instance, teachers bring their PBL planning template (Document A-5) when presenting during Critical Friends which includes a space for a driving question, description of context/authenticity of the project, what kind of project launch they will do, and other components of PBL that Forest High School expects teachers to incorporate into their PBL units. By using this common PBL planning document, teachers are reminded of the expectations for PBL implementation which serves as social persuasion of what's required for PBL implementation at Forest High School.

In addition to supporting collective efficacy via social persuasion, the Critical Friends protocol also serves as a source of mastery experiences for collective efficacy by providing opportunities for teachers to learn about projects their peers are planning to implement. For instance, Diana shares that it is through the sharing during Critical Friends that she has learned about projects that other teachers are doing, "So we're seeing what other projects people are working on. And then we give feedback to them, and ask questions about them. So we do know what projects people might be planning to do." By having teachers share projects with each other, this protocol provides mastery experiences for school-wide implementation of PBL;

teachers learn specifics about projects other teachers are implementing, supporting the message that they work at a school that is successfully implementing PBL. Angie shared, "I go to my PLC because we're all doing projects. And so they all have ideas." Angie is recognizing the expertise of her colleagues in terms of implementing PBL which can enhance her collective efficacy for school-wide PBL implementation by learning that many of her colleagues are planning PBL projects.

Teachers also shared how the use of this protocol and the PLC model supported positive affective states at Forest High School by developing relationships. As I described previously, there is a supportive, trusting culture at Forest High School. Teachers also talked specifically about the role PLCs played in this supportive, trusting culture. Jim described his PLC as "a good group of us" and says his PLCs are "quite fun" reinforcing this idea that PLCs provide positive affective states for him. Arthur, the principal, described how his veteran staff are "always hungry and excited to support everyone else." His belief in the role his staff would play in encouraging and supporting new teachers shows how he knew PLCs could support positive emotional states. In a follow-up email, Caroline discussed the importance of the Critical Friends Protocol specifically for creating this positive culture, "it engages staff and students in a practice of sharing imperfect work, accepting and using feedback, and improving work based on data. It establishes a 'workshop'/collaborative culture as opposed to independent contractors." In other words, this opportunity to share a project that is in development and get support and ideas from fellow teachers also serves as a vehicle to build a supportive, trusting culture. Positive affective states, like feeling supported and trusted, enhance collective efficacy in that teachers feel more positive about their ability to implement PBL as a staff.

Learning with and from each other about PBL

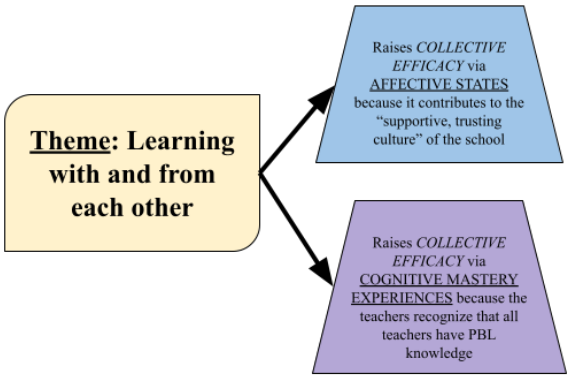
Forest High School has a long history of robust professional development. From participating in week-long summer workshops, to traveling to international conferences, the teachers at Forest High School have had many opportunities to learn with and from each other. This culture of "learning with and from each other" about PBL relates to two sources of collective efficacy: mastery experiences and affective states (see Figure 4). In the following section I will provide details about how this was evidenced at Forest High School.

In the years prior to the COVID-19 pandemic, Forest High School had extensive training in PBL where the whole staff learned about PBL together. Teachers were invited to summer

workshops that lasted between three to five days. Several teachers shared these experiences. Here Alan explains, “they would offer [PBL] network training to all new staff.” He went on to say that the network that Forest High School belongs to had “this yearly conference in the summers. And so I went to that after my first year of teaching.” Lucy also shared, “I was trained at [the] networks conference, I went for a couple days in the summertime.” She added she also was able “to go away to a conference, you know, in Helsinki for like, a week.” Professional learning is considered a cognitive mastery experience for PBL implementation and can enhance collective efficacy in that it provides teachers with the knowledge of how PBL is enacted. By learning together, staff members recognize that their peers also have knowledge and skills related to PBL implementation, increasing their collective efficacy. By offering these summer trainings and conferences, teachers were able to see that all teachers at their school had the knowledge and skills necessary for successful PBL implementation building collective efficacy.

Figure 4

Relationship of theme “Learning with and from each other” with sources of collective efficacy for Forest High School



In addition to bringing outside people in for school-wide training, Forest High School also encourages veteran staff to train newer teachers about PBL implementation. This culture of teachers supporting each other continues to build cognitive mastery experiences (recognizing expertise for PBL in the school) and also a positive affective state (peers being supportive and enjoying learning together). Lucy described how she and other teachers were guiding newer teachers at Forest High School:

> A lot of the senior teachers here, me being one of them, are really working towards, like training some of the new teachers. Working in PLCs, you know, teaching them like, what

is PBL? And what does it look like here at our school? Or what can it look like? That kind of thing.

These learning opportunities create a sense of community further bolstering the supportive, trusting culture at the school and positive affective states. Angie said "I truly do love it" when describing all the collaboration among teachers that happens at Forest High School. Her positive feelings about professional learning were echoed by Caroline. She reflected on how the training she received when first coming to Forest High School influenced her, "it was a part of the culture that every summer we would engage in a week-long training and conference together. There was a whole culture around adult learning that was very, very impactful for me as a new teacher." The teachers at Forest High School benefited from the culture of learning from and with each other through the mastery experiences it offered and the positive supportive culture it fostered. Both of these are sources of collective efficacy that bolstered teachers' perceptions of the ability of their peers to implement PBL effectively. This culture of learning from and with each other provides mastery experiences and positive affective states that can enhance teachers' collective efficacy for PBL implementation.

Themes related to sources of teacher self-efficacy and PBL implementation at Forest High School

In interviews with teachers at Forest High School and through document analysis, the evidence produced a comprehensive picture of how all four sources of self-efficacy (mastery experiences, vicarious experiences, social persuasion, and affective states) influenced teachers' self-efficacy for PBL implementation (see Table 7 for examples of interview quotes and document analysis that exhibit sources of self-efficacy). In this section, I will highlight the key themes of how teachers at Forest High School talked about the sources of self-efficacy.

The importance of affective states: Enjoyment of implementing PBL and alignment with beliefs

Bandura (1997) posited that one of the sources of self-efficacy is affective states, explaining that when an individual experiences positive affective states while completing a task, they will feel more capable and confident in their ability to complete that task in the future. Teachers at Forest High School used positive descriptors when referring to implementing PBL. They described positive affective states in two ways, (1) as enjoyment of PBL and (2) as alignment between PBL and their own skills and beliefs. While I did not ask direct questions

about physiological states while teaching PBL, the words that teachers used to describe their PBL implementation indicate positive feelings they have while implementing PBL which signals high efficacy. Participants often described PBL in positive emotional terms, expressing "enjoyment of implementing PBL." They used expressions like "super cool," "it was a blast," and "pure fun." Their voices would pick up and animate as they described projects they had implemented. Katarina teacher took a breath after describing a project she'd worked on that day and said, "I literally could talk about PBL, probably all afternoon." This pattern repeated itself with all teachers, even those new to implementing PBL. While other research about affective states has focused on anxiety or stress teachers may feel teaching, the participants from Forest High School spoke much more frequently about the joy implementing PBL brings them. Caroline shared that while she put a pause on PBL implementation during the COVID-19 pandemic, she felt immense relief when she returned to implementing PBL, "I was reminded, again, I was like, 'Oh, this is so refreshing.' The students are like, 'What's a watershed?' And you know, they're asking questions, and it's like, oh, good, thank goodness. It was a breath of fresh air." This reference to PBL as a "breath of fresh air" conveys a positive physical response for Caroline when she returned to PBL implementation.

Similar to the positive emotions teachers expressed about their enjoyment of implementing PBL, teachers from Forest High School also repeatedly shared how teaching PBL felt natural to them, that there was an "alignment of PBL with their own skills and beliefs." Feeling in sync with the way they are teaching allows teachers to be at ease with their instructional approach. The teachers from Forest High School in this study seemed to have a deeper sense that implementing PBL was in line with their own style and beliefs, lowering stress and anxiety. For instance, even though Theresa was in her first year at Forest High School, she was already feeling aligned with PBL as a pedagogy, "I really like that portion [of PBL]. And that's just because of who I am, right?" Some teachers elaborated on this theme, giving specific examples of aspects of PBL they thought they had especially good skills for and interest in implementing. Caroline mentioned that she knew her knowledge of the community made her especially good at planning authentic projects, "number one knowledge that is super helpful is knowing my community." Jim shared that he knew he was good at knowing when to focus on skills or content, "I'm comfortable turning on the concept versus skill level on assignments." They talked about feeling like they were very good at helping students navigate collaborating, or

at understanding when a student needed more support, or when to reach out to experts for help. Several teachers talked about being comfortable with not being in control and allowing the messiness of projects. Lucy specifically mentioned that she's learned to launch projects without overplanning, "When I rolled out that project, I had no contracts. I had no lessons planned, I had nothing. And it wound up being award-winning." This recognition that being comfortable with the chaos of PBL signifies an important indicator that these teachers have high efficacy for PBL implementation. Other teachers talked about how the authentic connection to the content and to the community was meaningful for them in a way that resonated. Caroline shared, "Addressing really real issues and giving students a seat at the table when it comes to things that matter, and knowing that they matter. And so both of those things were really important to me as a person." While these comments are not as proximate to Bandura's definition of affective states such as noticing physiological changes during a task (shaky hands, speeding heart, etc.), the deep connection these teachers felt with the ethos of PBL and the concomitant positive emotional states indicates a positive influence on teachers' self-efficacy for PBL implementation. When I reached back out to the teachers at Forest High School about what factors most influenced their encouragement to implement PBL, four of the five teachers that responded said "enjoyment of PBL" was most influential. This alignment to PBL skills and beliefs along with the high degree of positivity expressed about PBL implementation demonstrates the importance of positive emotional states for influencing how teachers feel about PBL. For these teachers, positive affective states were a highly influential source for self-efficacy for PBL implementation.

Having mastery experiences: "Doing PBL" and seeing the results

Bandura (1997) posited that mastery experiences made up the strongest source of self-efficacy. In the interviews with staff at Forest High School, there were several ways that teachers discussed mastery experiences. (1) Teachers described successful PBL projects and highlighted high-quality PBL design elements and teaching practices in their descriptions. (2) Teachers described how their implementation of PBL improved over time. (3) Teachers described student outcomes from their PBL implementation and how these outcomes indicated PBL success. I will describe each of these in more detail below.

Mastery experiences are considered the primary source for self-efficacy. For these teachers, the actual experience of "doing PBL" and doing it in a way that aligned with high-quality PBL was the most common way they spoke of their success implementing PBL. These

descriptions and artifacts of PBL implementation were significant examples of recognizing that their past implementation of PBL served as mastery experiences by meeting their goals for PBL. For teachers to recognize their PBL implementation as a successful mastery experience, they must have clear criteria for determining a successful project. In Forest High School, teachers didn't just describe a project but referred to specific aspects of PBL that indicate high-quality implementation. These elements include authenticity, student voice and choice, public products, driving questions, opportunities for critique, revision, and reflection as well as high levels of student collaboration. For instance, one teacher from Forest High School described a project that met several of these quality indicators. For this project, students wrote children's books and presented them at a local elementary school. In her description Angie highlighted the student voice and choice aspect of the project, "I think them having that ability to find somebody that might just be that 'ordinary hero'… letting them have that freedom to do who they want and learn about a particular topic" was meaningful. In addition to talking about student voice and choice, Angie also referenced opportunities for students to get peer feedback and revise their work which are also high-quality indicators for PBL. By highlighting these high-quality elements of their projects, teachers were indicating that these past examples of PBL implementation were mastery experiences. Another participant, Alan, described a voting project his students completed in which they prepared informational pamphlets for the Registrar of Voters in their town. Alan explained how letting students choose their own topics of interest increased the authenticity of the project:

> They could just follow whatever their curiosity was, and then make a case for it. And then at the end, when I'm when I'm asking them to defend their work, their defense is authentic, right? Like they, they did the thing they did for all the reasons and here's why. And their answer isn't "uh because you told me to put this stuff in it."

Alan knew that projects that had authentic purposes and audiences were high quality elements of PBL and by highlighting these features of the project was indicating that his PBL implementation was a mastery experience. Forest High School had a project template (Document 5A) that teachers could use to plan and share their projects. This template highlights key aspects of PBL that teachers should incorporate into their PBL units like driving questions, authenticity, and alignment to standards. Teachers at Forest High School were well-versed in what high-

quality PBL should include and provided evidence of PBL units that they implemented to demonstrate their self-efficacy for PBL implementation.

When describing and sharing artifacts of their past PBL units, teachers also reflected on how implementing PBL got easier the more they did it. Teachers shared that the more they did PBL, the more successful they felt. Lucy described the confidence she has as an experienced PBL teacher, "I'm just used to it by now. I have so many things in my back pocket that I can go back to." Some participants got even more specific about this, talking about how the experience of implementing PBL over the years gave them specific skills and perspectives that made continuing to implement PBL more successful:

> Understanding what appropriate expectations are for discomfort through learning is important and how to support kids in those different places. Because I think, understanding almost like the flow, the emotional flow of a project, you know, you have excitement right at the beginning, and you know that that's not going to last forever. And then seeing the signs when is it time to, like, reinject something that's gonna re-engage students in this topic? I don't know if that makes any sense or not, but kind of knowing what to expect. (Caroline)

Being able to have repeated experiences implementing PBL was key to teachers experiencing mastery. This ability, to have repeated mastery experiences, demonstrates how mastery experiences fostered teachers' confidence in implementing PBL and reassured them of future success as they implemented more projects.

Teachers at Forest High School also determined if past PBL implementation was successful by reflecting on student outcomes. When teachers reflected whether past projects were successful, they often commented about how they saw the students learning the content deeply. Jim shared the difference he saw with PBL from traditional, direct instruction, "That's the bigger point. And when you're put in this situation as a learner, you learn quite a bit more than just do worksheets and a quiz. I feel like this [PBL], it offers more opportunities for learning." He felt that his ability to draw out this deeper learning in his students made him successful at PBL. Another teacher, Theresa, highlighted that she feels successful with PBL when she sees students making connections among different aspects of the curriculum and the projects, "a student's like, 'Wait a second, you said this and this. But can't that be applied to this?' And I'm like, 'Yes, exactly.'" This feedback from students in the form of evidence of

deeper understanding of content served as mastery experiences for teachers that their capabilities of implementing PBL were strong.

Teachers also talked about the interpersonal and intrapersonal skills students develop as a source of their self-efficacy for PBL. For instance, Caroline saw her prior success with PBL as being related to the skills her students learned about how to lean into difficult tasks:

> I would say what gives me confidence is seeing the students ask questions and push themselves and really do hard things. You know, they just recently, oceanography [class] just presented to some county supervisors recently, and city planners. They were so nervous to do this. Their first drafts were very basic, and they didn't know what to do. And, you know, after several rounds of feedback, and really just like, layering on skills, they've really nailed it. So it's, I think, what makes me feel confident is seeing my students improve, and their deeper learning skills.

Caroline is reflecting on students' growth with interpersonal skills like communication but also on intrapersonal skills like perseverance and grit. Similarly, in Lucy's blog post about a PBL she completed after the COVID-19 pandemic, she reflected about all the skills students developed as a result of completing the project:

> It was so meaningful to have adults from the community in the classroom again. Their presence highlights the skills students are developing: collaboration, speaking skills, writing skills and project management skills, all while holding the highest standards for craftsmanship and precision. It's nice to know that PBL still really does work. (Document A-9, rephrased to protect participant's identity)

Here Lucy is highlighting the interpersonal skills her students gained from PBL implementation: communication skills but also collaboration skills. Seeing students develop skills around perseverance, project management, and communication provided teachers at Forest High School feedback that their PBL implementation was strong and would likely continue to be strong in the future.

Social persuasion focused on student, coach, and administrative feedback

Social persuasion (or verbal persuasion as it is sometimes called) refers to input that persuades individuals that they have the capabilities to master specific tasks (Bandura, 1997). Teachers get feedback on their capabilities in a variety of ways: administrator, parents, peer, and student feedback. At Forest High School, teachers emphasized the importance of student, coach,

and administrator feedback and encouragement that leads them to believe that they have the skills to implement PBL. In Forest High School many teachers actively sought out feedback from the students. Stacey shared, “I also am absolutely okay with looking at students and saying, ‘Where am I screwing this up?’ And they love to tell you where you're screwing something up.” Teachers were even comfortable with negative feedback from students, finding it useful for improving their PBL implementation and increasing their efficacy. The principal, Arthur, shared how he recognized that this was a common practice at the school:

> I know a lot of them will get feedback from students at the end of the project. And just really get that student perspective. Not just about like if they liked the project or not, but how they felt, if there was peer to peer grading happening for certain parts of it, or if the benchmarks all felt appropriate and timely or if they felt too rushed or what other ways final presentations can happen.

This was echoed by many of the teachers. Teachers shared that they would ask students for project feedback in the moment. Jim mentioned, “I'll ask kids, what would we, what would be different on this? So I'll change it like and they'll give me good ideas.” Teachers also described seeking student feedback in the form of a planned focus group. Stacey described, “I will often pull together kind of a little focus group and say, ‘This is what I'm thinking about. This is what I'm planning. What do you guys think?’” Teachers at Forest High School were comfortable soliciting this feedback from students and recognized that even negative feedback from students served a purpose to enhance their capability to continue to implement PBL successfully.

While many teachers at Forest High School prioritized feedback from students, many teachers also sought and felt supported by the feedback they received from coaches and administrators. Theresa shared how helpful feedback from her administrator has been as she learns how to implement PBL, “So I sit down with my, you know, with my vice principal, and we talk about, you know, things that I want to work on or things that he's observing. He's observed me a couple times. So there is somebody who I can talk things out with, which is very helpful.” Theresa finds the opportunity to ask questions of her administrator and get direct feedback on her teaching gives her confidence to continue to implement PBL. Alan, one of the administrators echoed that he thought the ability to give feedback to teachers so that they can improve was also helpful in supporting PBL implementation at Forest High School:

> And to be fair, I think it's probably the best thing. You know, I think we can we can toss things to teachers, and oh, try this or do this. But I think having teachers try a thing, like, get some feedback on a thing, try it, reflect on it and have partners to reflect on and I think is the number one way that people learn, period. And so I think that that's probably the most valuable thing that we do.

Caroline elaborated on this in her interview. As a teacher with many years of experience implementing PBL, she reflected on what she thought could make the biggest difference for teachers that are still uncertain in their PBL implementation:

> I think what would give them confidence would be to have an administrator say, "I would really like you to try doing a project. And I want you to start with these three things," and just give them a very small list of trying things out. And I would say, one would be like a public product. So that could be art that's visible in the library, or it could be a documentary showing in this school cafeteria, some kind of visible product. One would be a launch, something that hooks and engages the students could be a field trip or a lab, or a guest speaker. And I would say, the next, the last one would be to have a calendar of revision rounds. So make sure there's room for revision drafts, and, you know, getting feedback and improving work.

In addition to feedback, or social persuasion, from administrators, teachers benefit from other sources of social persuasion including instructional coaches. Forest High School has had PBL coaches in the past and teachers referred to how supportive a coach can be. Katarina talked about how prior to the pandemic there was a coaching position and how that experience of getting feedback from that person influenced her ability to implement PBL. "We had a staff member whose job was to support PBL, for the teachers at the school. And I still remember, you know, so many times that she would observe and she had rubrics for me as a new teacher." One of the teachers at Forest High School that maintains a blog about PBL implementation commented about the important of professional guidance as well, "Teachers who are learning new methodology (such as PBL), working with a shift in student population, or are new to the profession need special support and encouraging guidance from administrators and peers." She then goes on to describe important influences on her own PBL implementation and how social persuasion in the form of feedback was important for her. When Bandura (1997) describes the role of social (verbal) persuasion he clarifies that the best social persuasion is encouraging with

specific, realistic, growth-oriented feedback from a source that is respected. It is clear that at Forest High School teachers seek out this kind of social persuasion from students, coaches, and administrators and that this feedback can enhance their self-efficacy for PBL implementation.

Seeking vicarious experiences

Vicarious experiences are seen by Bandura (1997) as a strong influence on self-efficacy. Vicarious experiences involve seeing others perform a task successfully, resulting in the belief that one can also perform that task. In terms of vicarious experiences for PBL, seeing other teachers successfully implement PBL can provide vicarious experiences. At Forest High School, teachers referred to vicarious experiences in three ways: PBL mentors, online examples, and comparing their own PBL implementation with other teachers' PBL implementation. In the following section, I will elaborate on each of these and describe how teachers provided examples of each.

One way teachers at Forest High School had vicarious experiences was through engaging with mentors, or peer models who are available to co-plan with, collaborate with, or observe. In Forest High School, teachers talked of looking to other teachers as sources for their growing self-efficacy when peers served as mentors. Two teachers spoke about the importance of having an ongoing peer mentoring relationship related to implementing PBL. Angie and Stacey clearly credited peer models with increasing their own ability to implement PBL. Angie described a teacher in her department that had prior experience with PBL, "I just kind of fell under his wings. And he said 'Oh, no, this is what we're doing. We're doing PBL.' And so from the get-go, I've been a PBL teacher." In Stacey's case, she had several teachers in her professional learning community [PLC] that were all PBL veterans, "I collaborated with other teachers on staff who were more senior than I was to sort of, like, understand how it all worked." For Angie and Stacey, these peer mentors served as vicarious experiences that provided models of how to do PBL, increasing the belief that they were also capable of implementing PBL.

While not all participants had an ongoing peer model that served as a vicarious experience for them, they did use a variety of strategies to find other examples of PBL implementation that could serve as a model. For some participants, this model was via Forest High School's learning management system where they could access projects other teachers had done. Caroline shared:

> We also have something called [name of learning management system omitted], and we can see each other's classes and grade books and projects. And I'm a nerd. So I go in there sometimes, and I peek around, and I want to see what they're doing.

In addition to looking at the learning management system, teachers also used a project database provided by the school to see examples of PBL units that other teachers had implemented. Some participants shared that they used search engines or social media to find project examples. Jim shared, "I follow certain math people and they present really interesting math problems, and some are, and they're good, and some are very unique. And they allow for rich conversations and interesting ways to present problems I wouldn't have thought of." Still other teachers joined communities with colleagues who taught their same content at other schools. For instance, Katarina participated in a World Language PBL group at a local university. In referring to that community, she said "I think that really helped me establish my practice." Forest High School teachers also shared that they saw project examples around the school, at open houses, and via the project spotlights the principal sent out. Diana specified, "we do have Project Spotlights that are nice, because we get to see what other projects are that people are doing." This "patchwork of PBL models" was a combination of models that teachers sought out and structures set up by the school that served as vicarious experiences for teachers regarding PBL implementation.

Teachers in Forest High School also discussed asking students about what projects other teachers are doing as a means of finding PBL models. Jim shared that he learns about other projects in an informal way, "sometimes the kids, you know, the kids letting you know, what they're doing, or what their projects are." The design of schools is such that teachers spend most of their day with students so it is logical that students might serve as a source of information about how other teachers enact PBL in their classrooms. Theresa shared how she'll ask students about projects in other classes, "Tell me about that class. And let me see how I can bring something that you're learning from that class into my classroom." Hearing about the projects from students or actually seeing artifacts from PBL in other classes was a commonly reported method for seeking out information about how peers were implementing PBL. It is interesting to note that in an ecosystem of a school, teachers may learn about other teachers' PBL implementation as much through these unofficial, socially dispersed opportunities as in formal structures like PLCs or staff meetings.

One tricky aspect of vicarious experiences and using a patchwork of PBL models is that depending on the relationship between the individual and their model, the skill of the model, and the prior level of efficacy of the individual, the model may increase or decrease the efficacy of the teacher (Bandura, 1997, Usher, 2009). In some cases, teachers expressed high efficacy when "comparing PBL implementation" between themselves and another teacher. For instance, when Lucy was describing the level of student leadership during her projects, she stated, "That's, that's really different than most teachers, right? That's a very different experience than traditional learning." She was conveying that she was aware that her implementation of PBL resulted in a truly student-centered classroom in a way few other teachers are able to achieve. Similarly, Caroline reflected about her own skills and beliefs that led her to continue to implement PBL post-COVID 19 pandemic when her colleagues had stopped, "part of what I'm basing it on is resilience. Honestly, at this point, I mean, I see around me, I know that I have colleagues who have burned out." In both of these cases, vicarious experiences led to a heightened confidence in their ability to implement PBL. In other cases, teachers saw these vicarious experiences as inspirational. Katarina spoke the same way about a project at Forest High School that a peer implemented, "The first year she did the project… She won a big award. So that's the kind of thing you're always thinking, like, how can I get my students' project to be public?" In this case, Katarina sees the possibility of having an award-winning project while recognizing that her work is not currently at that level. This vicarious experience can still serve to increase her self-efficacy because seeing her colleague win an award signals that it is possible to implement PBL at this level and increases her own belief in implementing an award-winning project. Vicarious experiences presented at Forest High School as a true "patchwork of PBL models" in the forms of peer mentors, online PBL resources, professional learning communities, learning about projects from students, and comparing their PBL implementation with colleagues' implementation.

Teachers from Forest High School shared several influences on their self-efficacy: the positive affective states from their enjoyment of implementing PBL, the confidence that repeated mastery experiences of implementing PBL brought, the social persuasion provided by student, coach, and administrative feedback, and a patchwork of PBL models that served as vicarious experiences for PBL implementation. These themes all demonstrate ways that individual teachers at Forest High School developed self-efficacy.

Challenges to collective efficacy

Thus far I have described various ways that the sources of self- and collective efficacy contributed to high self- and collective efficacy at Forest High School for PBL implementation. In addition to discussing the various features of their school that contributed to their collective efficacy for PBL implementation, participants also shared aspects of their school that lowered their collective efficacy for PBL implementation. Teachers expressed four main concerns that lowered their collective efficacy for PBL implementation: a lack of PBL expertise, concerns about the fidelity of PBL implementation, misalignment of PBL with district priorities, and a lack of structures to support PBL implementation. I will next explain each of these challenges and how each relates to different sources of self- and collective efficacy.

Lack of PBL expertise

In the years prior to this study, Forest High School experienced a high amount of staff turnover. In addition to the upheaval of the COVID-19 pandemic, there was a change in leadership, and several staff retirements or relocations. With so many new staff members being onboarded and veteran PBL teachers leaving, participants noted a "lack of PBL expertise" which challenged teachers' collective efficacy for PBL implementation. Both teachers and administrators shared that new staff received uneven training in PBL. Arthur, one of the administrators revealed, "that's five, six teachers that we've hired in the last few years that didn't go through any formalized training up until this past summer." Stacey, a more experienced staff member, noted, "we've got an art teacher who's been there three years, but nobody's ever taught her to do PBL." This sense that several teachers have not developed a PBL expertise detracted from teachers' sense of collective efficacy for PBL implementation. Instead of peer mentors and models that were all highly proficient in PBL, some teachers saw that teachers around them did not know PBL well and had not been trained. This lack of mastery experiences left teachers unsure of how well they, as a staff, knew PBL.

Concerns about fidelity of PBL implementation

Related to the "lack of PBL expertise," another challenge to collective efficacy for PBL implementation was "concerns about fidelity of PBL implementation." In addition to being concerned that not all teachers understood how to implement PBL, staff at Forest High School was also concerned that even those who had been trained on PBL weren't implementing it regularly. Alan, one of the school administrators shared, "We are at a place right now in which

the level of consistency with [PBL] isn't as great as it has been in the past, largely because we just had a lot of, like all schools have, staff turnover." There was a feeling that after the disruption of the COVID-19 pandemic, some teachers never returned to implementing PBL in their classes. In addition to this general feeling, several teachers specifically mentioned that math "is not doing PBL." Two math teachers that participated in the study described their approach as *problem*-based learning not *project*-based learning. Jim described the problem-based learning approach the math department was using this way, "So problem-based, meaning here's a, here's a problem, how do we solve it? And then you go through a little exploration, which is a day or two, and you cycle back to answer the problem." While problem-based learning shares a lot of features with project-based learning, this difference created a sense of a non-mastery experience for some teachers in that they felt this meant that not everyone was doing PBL.

Lack of structures that support PBL

While teachers shared that the Critical Friends Protocol and professional learning communities enhanced their self- and collective efficacy for PBL implementation, there was also some concern that these practices had previously been a more regular part of the school day and academic year than they currently were. This "lack of structures that support PBL" came up in several interviews as a concern and a challenge to the collective efficacy of the staff. Stacey described how she used to learn about PBL from peer models via the Critical Friends Protocol but shared that "our struggle right now is we don't have a lot of time to engage in that." Lucy spoke more generally about missing time to just collaborate with her peers, "we used to have more collaborative time to work together, that we don't anymore." Without being exposed to vicarious experiences or the collective social persuasion that normally occurs during these structures (Critical Friends and PLCs), staff at Forest High School have less of an opportunity to strengthen their collective efficacy for PBL. Because Forest High School has many structures in place that support collective efficacy for PBL implementation, the current lack of structures that support PBL was not having a huge impact on the collective efficacy of the school. However, from participants' comments, it is clear that the lack of these structures was influencing collective efficacy for PBL implementation.

Misalignment of PBL with district priorities

A final factor that influenced collective efficacy in Forest High School was that the staff at Forest High School felt the school district had different priorities other than PBL. Teachers

talked about having to meet regarding textbook adoption and literacy strategies instead of developing and refining their PBL practices. This "misalignment of PBL with district priorities" created negative affective states for the staff at Forest High School by creating tension between implementing PBL and meeting district mandates. Participants used language like "pushed" and described the situation as a "struggle." This misalignment of priorities created tension and stress for the teachers at Forest High School who wanted to be able to use their PLC time to focus on PBL. Stacey specified, saying, "we need some time for the district to not tell us what to do so that we can just do this thing we do [PBL]." This misalignment created a negative affective state for the teachers at Forest High School detracting from their sense of collective efficacy.

Summary of Forest High School, sources of efficacy, and PBL implementation

Forest High School has a long history with PBL and has developed both concrete strategies and procedures that support PBL as well as a supportive culture which has created a mature level of both self-efficacy and collective efficacy for PBL implementation. Strategies such as robust professional learning that includes teachers learning from each other and PLCs that use protocols such as Critical Friends Groups provide opportunities for teachers' self- and collective efficacy to develop via multiple sources of efficacy. In terms of mastery experiences that develop collective efficacy, these strategies provide multiple ways for teachers to recognize that their school is consistently implementing PBL. The clear expectations the school has set for PBL via project planners, clearly stated mission and vision statements, and CFG protocols provides clear expectations for teachers about what successful PBL looks like, ensuring that teachers can have mastery experiences because they know what successful PBL should look like. Vicarious experiences are also supported through the CFG protocol and multiple opportunities for teachers to learn deeply about other teachers' projects. Forest High School also provided many opportunities for social persuasion that enhanced self- and collective efficacy. Teachers at Forest High School got feedback from students, peers, and administrators regularly in ways that enhanced both self- and collective efficacy for PBL implementation. Perhaps most striking was the very supportive and trusting culture that existed and the positive affective state that was created as a result. Teachers at Forest High School felt supported by each other and their administration and this had a strong influence on their efficacy for PBL implementation. Furthermore, teachers at Forest High School spoke passionately about their enjoyment of implementing PBL and how PBL aligned with their own skills and beliefs. These personal

positive affective states also fostered high self-efficacy for PBL implementation in that teachers felt an ease and comfort with employing a teaching method (PBL) that their school supported and that they felt good about implementing. Forest High School does have some challenges to maintain this high level of collective for PBL implementation. The high rate of turnover has meant new teachers have not gotten the same level of professional learning about PBL that the veteran teachers received. There also seems to be some department-based differences about expectations around PBL if it means project- or problem-based or both. Also, messages from the larger school district are unclear if PBL can continue to be central to the work at Forest High School. While these challenges present some threats to self- and collective efficacy for PBL implementation at Forest, their rich ecosystem of support, much like a firmly established forest, has resulted in an overall high and mature level of efficacy for PBL implementation.

Profile of Park Middle School

Park Middle School is a public middle school in a large school district in a mid-Atlantic state. The school enrolls over 1,000 students in grades 6-8 and is majority White (75.5%) with 12% of students eligible for free or reduced lunch. Performance on standardized testing has been consistent at Park Middle School with students scoring above the state average in both Reading and Math for several years. See Tables 2 and 3 for more details about the demographics of Park Middle School. Park Middle School had several years of stability prior to the COVID-19 pandemic as the current principal has been their leader for ten years and was a principal at two other schools for 12 years prior to starting at Park Middle School. Park Middle School launched their PBL journey several years ago when Park Middle School's school district began focusing on PBL as a promising practice. After the principal at Park Middle School showed interest, the school piloted PBL with a small group of teachers (2017-2018) and then trained all staff members the following year (2018-2019). As Paul , the principal explains, "Basically, by the end of the summer, and the start of the school year (2018-2019), we had close to 100% of staff trained in the PBL model." All teachers were expected to teach at least one PBL "experience" per quarter which Park Middle School defined as a one-to-three day learning experience that had a driving question and some of the other elements of high quality PBL (for more on how Park Middle School defines PBL experiences, see subsection "Redefining PBL"). Information was sent out to parents about PBL regularly and students were taught PBL terminology in their advisory classes, which met daily (Documents B-4 and B-5).

The COVID-19 pandemic had a negative impact on PBL implementation at Park Middle School. Teachers had to adapt their PBL implementation for online and hybrid instruction and the school district shifted focus away from PBL to social emotional learning and remediation to account for learning loss during the pandemic. Paul, the principal at Park Middle School explained, "Now the county is very focused on data and how we're going to regain the lost years from everybody. And it's more difficult to accomplish PBL because there's more of an emphasis, countywide, on scores and small group intervention." Despite set-backs during the COVID-19 pandemic and a shift in the school district's focus, participants in this study felt that they and their content learning teams had returned to their pre–pandemic levels of PBL implementation and were able to cite a number of different projects their students were engaged in. When asked to rank themselves on a scale from 1 to 10, with 1 indicating that they are just starting to learn about PBL and 10 indicating that they are an award-winning PBL teacher, responses ranged from an 8 to a 10 (mean = 9.08, n=3). Despite the pandemic interruption, Park Middle School still seems to be finding ways to ensure that students have PBL experiences each school year with different subject areas and teams defining a PBL experience in different ways.

In the following sections I will first describe four themes that enhance collective efficacy for PBL implementation. These themes touch on multiple sources of collective efficacy. After discussing how these themes relate to collective efficacy for PBL implementation, I will discuss four themes related to self-efficacy. Each of these themes regarding self-efficacy focuses on one particular source of self-efficacy for PBL implementation: mastery experiences, vicarious experiences, social persuasion, and affective states. I will conclude by discussing two themes that are challenges to efficacy at Park Middle School.

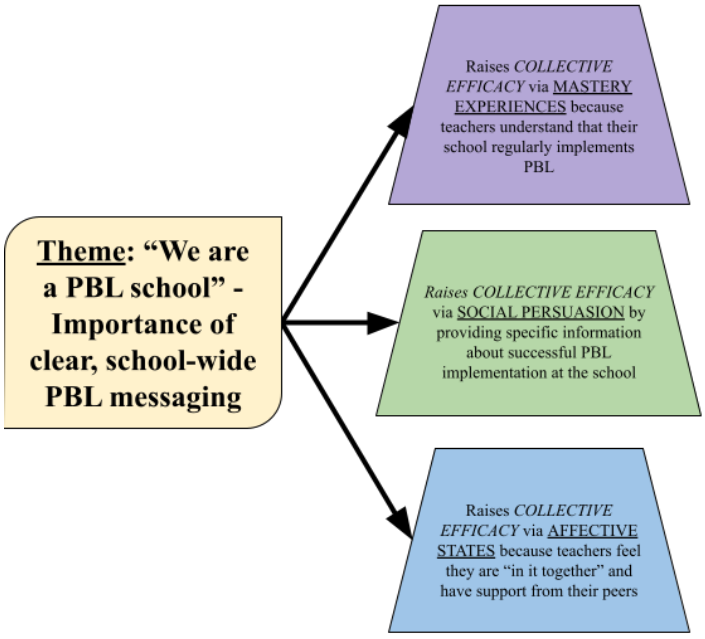
Themes related to sources of Collective Efficacy for PBL Implementation at Park Middle School

There are many structures in place at Park Middle School that provide sources for collective efficacy at Park Middle School. Four themes emerged at Park Middle School that relate to the four sources of collective efficacy: mastery experiences, vicarious experiences, social persuasion, and affective states (see Table 9 for examples of interview quotes and document analysis that exhibit sources of collective efficacy). In the following section I will explore each theme and identify the source or sources of collective efficacy related to that theme.

"We are a PBL school" and the importance of clear, school-wide messaging for PBL

Figure 5

Relationship of theme "'We are a PBL school' - Importance of clear, school-wide PBL messaging" with sources of collective efficacy for Park Middle School



Collective efficacy describes how the teachers at a school feel about the ability of the teaching staff to implement successful teaching and learning, and in these case studies focuses on their ability to implement PBL. At Park Middle School their shared identity as a "PBL school" and the clear, school-wide PBL messaging about PBL enhanced collective efficacy through several sources (see Figure 5). Below, I will explain how the teachers and administrators at Park Middle School described these sources of collective and self-efficacy as it relates to being a "PBL school" and the clear, school-side PBL messaging.

In Park Middle School, the principal and the teachers believed their school was successful as a PBL school and described the school as a "fully implemented" PBL school. Social persuasion and mastery experiences each played a significant role in how their collective efficacy as a "fully implemented PBL" school was enhanced. For example, Helen, a social studies teacher, commented that their school was "known as a PBL School. That's our title. That's what we're known as." Another teacher, Sarah, a science teacher, elaborated on the role of the principal in making that happen stating, "he [the school principal] decided to go full force into project-based learning and become a ['fully implemented'] PBL school." (quote edited to protect school anonymity). These beliefs are reinforced by the school's website that has a page

devoted to acknowledging its status as a "fully implemented" PBL school (Document B-1). It is clear from these descriptions that teachers believe that their school, as a whole, implements PBL and this is a point of pride. The principal explained, “we became a designated ['fully implemented'] PBL school. I was the only Middle School in my county to do that” (quote edited to protect school anonymity). In addition to naming “fully implemented PBL” as their school designation, staff also pointed out how their school was a place that other schools and district officials came to visit to see PBL in action. As Sarah stated:

> We've also had a lot of visiting schools that come in. And so you end up with a crowd full of people watching you do your PBL. We kind of got used to that, because not everybody's a [“fully implemented”] school. So I guess other other districts want to come in and see what that looks like. (quote edited to protect school anonymity)

One of the newsletters provided by the school principal (Document B-6) highlighted a visit of teachers from another county and what they observed about PBL implementation in the school. “They were very much impressed with teacher instruction and the level of engagement from students” and “our kids understand the meaning of the PBL elements and explained clearly what they were doing and why.” Whether these descriptions came from the principal, the school district, or their peers, this knowledge that their school was a PBL school provided social persuasion that enhanced their collective efficacy for school-wide PBL implementation.

In addition to these examples of social persuasion (being called a PBL school and being an example school for PBL), teachers also described knowledge of the high quality PBL that was happening at their school which served as mastery experiences of school-wide PBL implementation. To develop collective efficacy for PBL implementation, teachers need to believe that their school is actively and regularly implementing PBL. Being able to provide evidence of multiple teachers implementing PBL serves as mastery experiences to build this collective efficacy. Sarah described that she knows about other teachers implementing PBL because the projects are put on display, “on the walls in the hallway … or something's on the TV monitors in the library. And when you see products that are coming out of other classrooms, you're like, that's pretty cool.” She then discussed some specific examples of PBL projects that meet some of the characteristics of high-quality PBL like authenticity and public products:

> I've seen evidence of that [PBL], in so many different areas, they've got the art department, bringing in visiting artists, and the kids make these bowls that do an empty

> bowl dinner, and they have a whole community event. They're learning about the art process, but they're also learning to be, you know, community leaders and to help civic problems. It's just that kind of stuff is pretty amazing.

She further emphasized how she knows the PBL implementation is strong because the district leaders are not as heavily involved in the PBL training as they were initially, "I think they [the school district] feel like we're rolling with PBL now, and we know what we're doing." Helen talked specifically about different PBL elements that she sees around the school, "we do this the driving question, we do the sustained inquiry, we do the student voice and choice we do that. Yeah, we you know, we do all elements of it" and mentioned different courses that did larger projects at different times of the year, "so it just matters at what stage it is, sometimes math is full blown on PBL, sometimes, you know, civics right now is full blown, science will be eventually, in the springtime, full blown." These responses indicate that teachers are not just saying their school is a PBL school, but that they see examples of it on a regular basis and this consistent, repeated exposure to PBL school-wide fosters mastery experiences for collective efficacy for PBL implementation. These examples of mastery experiences for collective efficacy for PBL implementation cannot be cleanly separated from social persuasion. How teachers describe understanding that their staff is widely implementing PBL also connected to feedback about how the school is implementing PBL.

A main reason that teachers and staff could be certain that the PBL happening at their school was successful (and examples of mastery experiences) was because of the clear messaging and instruction provided by the administration (social persuasion). Once again here, the two sources of collective efficacy (social persuasion and mastery experiences) worked together to strengthen collective efficacy for PBL implementation. The principal at Park Middle School explained a few different methods he had for providing clear expectations to his teachers about implementing PBL. The first year of PBL implementation, all advisories (homeroom classes that meet daily) did lessons about eight high-quality design elements of PBL. This ensured that all students and all teachers were clear on what these elements were and what they looked like in projects:

> We did this out of advisory. We did. We front-end loaded it, meaning, the beginning of the year, sometimes you go over school rules for two weeks. We not only did the school rules, we also did a different element [of PBL] each day that were created by the advisory

> and the administrative team. So that not only would the kids be held accountable, but so are the teachers because the kids knew to expect to see reflection going on, they knew what it looked like. And then on that day, when we all did reflection, each teacher was supposed to do that in their class. And then when they did driving question, that was the focus for that school wide.

The principal then highlighted different elements in newsletters throughout the school year (Document B-5) supporting the initial advisory lessons with examples. Paul explained:

> We do a weekly newsletter, but monthly, I would do an update first for parents, hey, this week, we're going to this month we're going to focus on the driving question. Here's what it is. It's part of our PBL. And here's an example. And here's for teachers that are doing it.

Finally, the walk-through document that the school leaders used in Park Middle School highlighted these same elements so that teachers knew what the administrators were looking for when they came to classrooms. Sarah explained it this way:

> They would check off what elements they saw we were working on during the class and give us feedback on those things. So, you know, it's been a pretty consistent effort on the part of the administration to keep it as something our school is doing across the board.

This consistent, clear messaging meant that teachers understood what was expected school-wide in terms of PBL, Sarah emphasized, "they're [administration] united in, 'this is the way our school is. And this is how we expect teachers to be.'" This school-wide feedback served as social persuasion to the staff. Messaging from the principal about PBL expectations conveys to teachers that the principal believes that the teachers can meet these expectations and encourages them to do so. Conveying these messages not just to the staff but also to students and parents, strengthens the message that the principal believes his staff can meet these expectations and implement PBL using the elements outlined in the advisory lessons and newsletters. This social persuasion enhances collective efficacy for PBL implementation. Furthermore, these clear expectations also strengthen mastery experiences in that teachers have clear parameters of success to measure the school-wide PBL implementation against. For teachers to be able to determine if the PBL implementation happening around the school are examples of mastery experiences for school-wide PBL implementation, they need to know what successful PBL implementation looks like. By communicating clear, school-wide expectations, the principal at Park Middle School is

providing a set of standards with which to measure the PBL implementation. Clear, school-wide expectations provided both mastery experiences and social persuasion for PBL implementation.

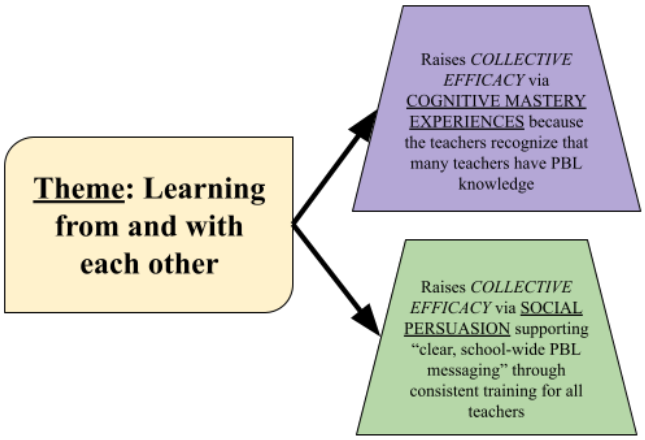
In addition, the clear messaging from the administration created a positive affective state for teachers that further enhanced their collective efficacy. Positive affective states for schools can be seen when there is a positive school culture about teaching and learning and low stress and anxiety about performance. Furthermore, a school staff experiencing positive affective states exhibits supportive behaviors where teachers feel a sense of community. For example, Sarah explained how the clear, consistent PBL expectations created positive affective states for how the school pulled together. In a follow-up email she stated, "having the entire school do PBL meant that we were all in it together and we could support each other. Not only did all the teachers understand the expectations, but eventually the students and parents did too." For her, the clarity of the messaging was supportive for her and gave the feeling that they were all "in it together." Furthermore, she knew that the students and parents were on board as well. Having the support of the parents and students meant that the staff didn't have to defend their choice to implement PBL, rather that they felt supported in doing so. Kyra also shared how impactful it was for her that the whole school was implementing PBL, "Being part of a PBL community definitely has a positive impact on my teaching." Being part of a community and feeling supported by your peers helps to maintain a positive emotional state. Teachers are not left feeling like they are isolated or on their own to figure out how to implement PBL. Working together and implementing PBL as a community supported positive affective states that reinforced collective efficacy for PBL implementation.

Professional development about an innovative practice like PBL is important to its success and usually the first step a school takes when implementing school-wide PBL. At Park Middle School there was both PD that was offered *to the staff* from PBL organizations and PD that was offered *by the staff* at Park Middle School itself. Both of these kinds of PD served to enhance collective efficacy for PBL implementation. In the following section I will describe how teachers and administrators explained the PD at Park Middle School and how the PD relates to two sources of collective efficacy: mastery experiences and social persuasion.

Learning with and from each other about PBL

Figure 6

Relationship of theme "Learning from and with each other" with sources of collective efficacy for Park Middle School



Learning about PBL as a staff is an important method for creating mastery experiences. One type of mastery experiences is cognitive mastery experiences which refer to the shared knowledge of a new practice. At Park Middle School, a great deal of effort was put into professional development, especially at the beginning of their PBL journey. Paul, the principal, explained, "by the end of the summer, and the start of the school year, we had close to 100% of staff trained in the PBL model." Teachers agreed that there was significant training. Sarah described how "they provided loads of training and resources in-house." Helen even said, "We had extensive training to the point that I could almost gag on it." This focus on professional development for PBL allowed teachers to feel that the whole staff knew what PBL was, creating cognitive mastery experiences. Because of the extensive PD offered, teachers recognized that as a staff they had learned the components of PBL.

Collective efficacy is also enhanced via social persuasion. An important way for social persuasion to exist in a way that enhances collective efficacy is for teachers to encourage each other to implement PBL and to share knowledge about PBL. Social persuasion can be specific feedback and encouragement, but it can also be more general in the form of conveying expectations. By having teachers present to each other about PBL, all teachers are getting the message that PBL is expected in all classrooms at Park Middle School. As teachers at Park Middle School began implementing PBL based on all the initial training that was provided at the school district level, the workshops shifted from outside PBL presenters to teachers and

administrators from Park Middle School providing the training for each other. This shift to teacher-run PD had additional effects on the collective efficacy for PBL implementation. By having teachers teach each other about PBL, there was social persuasion that PBL was expected and achievable. When teachers within a school teach each other about PBL the social persuasion gets even more specific. The message is that not only is PBL what is expected at our school, but also that any teacher can do it because the teacher sharing is doing it. Sarah provided an overview of how the training shifted to teachers and administrators support each other:

> We had small groups of teachers who were ahead of the curve who shared their experiences and provided ideas. Admin created a website with tons of links and resources for us to use at our own pace. We also did book clubs and other PD – ALL our PD was PBL for a few years.

Helen shared that teachers offered their expertise to each other, "people at our school were going, 'Okay, if you're working on your driving question, well, then I can come to you, and you can come to me.'" The sharing of expertise was then formalized during professional learning time as highlighted by Helen, who stated:

> If you signed up for revision, then you're over here, you know, or if you signed up for inquiry-based, okay, you're over here, you know, and kind of allowed us to pick our professional development that we wanted for a couple of times.

Kyra echoed this shift to learning from each other at the school, "we would do learning walks. Sometimes after school, the different departments have presented a component or an activity." She also shared that "we have done some during, like an after school meeting where somebody might host like a 10 minute like little thing in their classroom." Having teachers learn with and from each other also enhances social persuasion by sending clear messages about expectations for PBL – not just what is expected but that it is achievable because the presenting teachers have already begun doing it. By supporting these clear expectations with training and support from their peers, the message that the staff can meet these expectations and be successful in their PBL implementation raises collective efficacy.

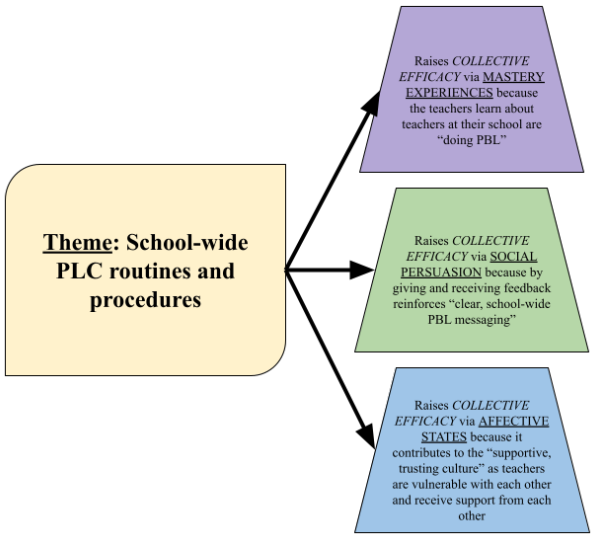
School-wide PLC routines and procedures

Park Middle School used a PLC structure called Content Learning Teams (CLT) where teachers of the same course would meet weekly. CLTs are a form of PLCs. For consistency in this study, I will refer to these structures at Park Middle School as CLT/PLCs. These CLT/PLCs

served many sources of collective efficacy. In the following section I will describe how teachers talked about each of CLT/PLCs and how that relates to sources of collective efficacy.

Figure 6

Relationship of theme "School-wide PLC routines and procedures" with sources of collective efficacy for Park Middle School



One way the CLT/PLCs at Park Middle school supported collective efficacy for PBL implementation was through mastery experiences. In these meetings teachers became more familiar with how knowledgeable their peers were about PBL. Teachers spoke of the importance of their CLT/PLCs in developing projects and feeling successful as a content level team. Sarah expressed the importance of her CLT/PLC for collective efficacy very effectively:

> You start to have those conversations, and you can draw from each other, which, you know, when you feel like everybody around you has a level of expertise, you know, you can draw from that and support each other. So I think that's helpful to have, you know, colleagues that are knowledgeable and have walked these roads and run into trouble and solved problems.

To Sarah, the collective knowledge of her CLT/PLC demonstrated that as a team they were successful at PBL implementation. Helen also shared how important a CLT/PLC can be for feeling successful about PBL implementation "The biggest thing that helps is to be put into a CLT. Where they're already doing it. And I don't know if that makes sense. So if you're a newbie, you really need to be put with a CLT that kinda knows what they're doing, and is rolling with it." Her description of a knowledgeable CLT/PLC as being important describes how having peers that you recognize as successful at PBL helps teachers new to PBL.

In addition to seeing other teachers implementing PBL, PLCs also serve as a source of social persuasion. Teachers at Park Middle School talked about how having a group to work with helped PBL feel manageable and provided a place for encouragement from their colleagues. Sarah said, “Working alone would be overwhelming and teachers would likely give up or do the bare minimum. Knowing you don’t have to do everything yourself helps reluctant joiners get on board.” Sarah clearly saw that CLT/PLCs can provide social persuasion in the form of encouragement. This ability of the CLT/PLC to help reluctant teachers along increased the collective efficacy of the group. Helen also talked about the importance of encouragement from her PLC:

> That, that's the biggest thing. Because when you think you have fallen flat on your face, someone needs to be there to go, “No, no, at least you tried something. You know, so it didn't work. Make it a PBL. What would you do different? What would you pick up and go again? What worked? What didn't work? What are you going to toss out? What do you want to keep? Where you gonna go from here?”

Helen’s example, that sometimes PBL goes sideways and you need support from your peers demonstrates how CLT/PLCs can serve as social persuasion. The encouragement and support teachers feel in their CLT/PLCs builds collective efficacy in that these larger groups are giving and receiving support indicating that PBL implementation can be successfully implemented by all members of the CLT/PLC.

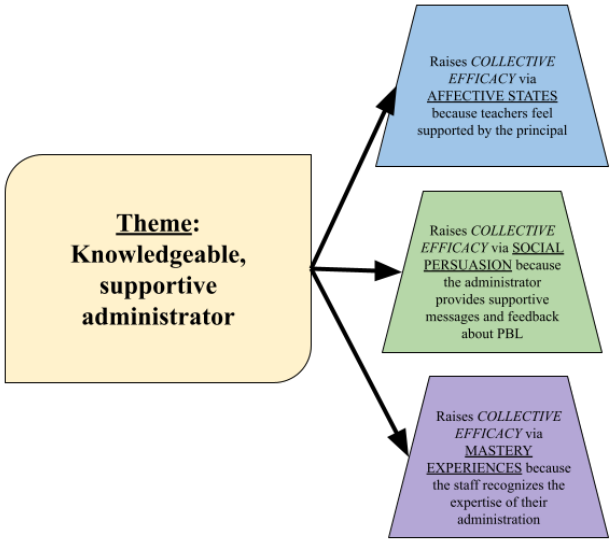
The CLT/PLCs at Park Middle School also supported positive affective states for the teachers in this study. Helen and Sarah both shared how their PLCs developed positive relationships. Sarah described how having multiple people in her CLT/PLC created an ideal atmosphere for collaboration, “we really work together a lot and bounce ideas off of each other. We all have different strengths.” She described how she and another CLT/PLC member shared a door between their classrooms and when she gets an idea for her PBL she’ll poke her head next door, “I'll get an idea in the middle of class. And I'll be like, ‘Hey, let's do this!’” Sarah also shared how the cohesiveness of her CLT/PLC helped her feel like implementing PBL wasn’t just up to her, “we support each other, you know, I feel like when I mess up in I've got someone that's behind me, that's gonna, you know, pick that up.” This positive teamwork helped Sarah have positive feelings about PBL implementation and lowered her stress about implementing. Helen shared the same feelings. While she said it took a little while for her CLT/PLC to coalesce, now

they "march to the beat of the same drum." She also found her CLT/PLC supportive sharing, "we definitely, as a civics CLT, have just come together really strong." Helen also shared that collaboration across CLT/PLCs was encouraged and that this collaboration served to support a positive climate across the school. She explained, "that collaboration, probably, and it made friendships because it kind of put us together." While affective states of stress and anxiety can often lower collective efficacy, CLT/PLCs at Park Middle School instead created positive affective states, communities where teachers felt encouraged and supported by their peers and shared their enjoyment of PBL with each other. CLT/PLCs at Park Middle School served as an important vehicle to develop collective efficacy for PBL implementation via mastery experiences, social persuasion, and positive affective states.

Knowledgeable and supportive administrator

Figure 7

Relationship of theme "Knowledgeable and supportive administrator" with sources of collective efficacy for Park Middle School



A final key aspect of PBL implementation at Park Middle School that contributed to increased collective efficacy for PBL implementation was the knowledgeable and supportive administration. Below, I will outline how the way administrators approached PBL implementation at Park Middle School supported collective efficacy (see Figure 7).

The teachers at Park Middle School shared how the supportive role of their principal allowed them to feel confident to try PBL, including new projects that had never been done before in a way that provided both positive affective states and social persuasion. Kyra said, "if I

have an idea, or we want to practice or do something they're all in." In a follow-up email, Sarah described how this supportive stance was more important to her than specific feedback about projects, "Feedback from administrators helped, but their support and patience with varying degrees of comfort with the transition was even better." Paul, the principal at Park Middle School, described the "positive heart posture" he and his assistant principals adopt:

> If we didn't see reflection, we don't say 'We didn't see your reflection, you've got to have that next time.' We'll say 'I loved your driving question. I love how your team is planning. Looks like some sustained inquiry is going on?' Keeping that pressure and positivity.

This focus on the positive allowed teachers to feel confident as they tried out this new pedagogy and weren't worried about any "gotcha" moments or feeling like they had to do things perfectly. Sarah shared how this helped the school as a whole approach PBL instead of resisting it:

> So and if they were being asked to do that [full, perfect PBL] they would be screaming and crying, you know, and fighting it. Whereas, you know, when, by kind of letting us take it one step at a time, it gave that level of comfort where people could become confident… But people, I think, felt they could grow. Yeah, they didn't have to do it all at once, it's okay to be PBL-ish, and you don't have to go full bore. And just knowing that I think especially for the reluctant teachers or the teachers that are unfamiliar, this not this doesn't come naturally to them. It was a big relief to say, okay, I can try this in a small way and see how it goes.

Sarah is specifying here that the administrators avoided creating a stressful, negative atmosphere, and instead created a positive, relaxed culture about trying PBL. And, this positive atmosphere increased teachers' comfort with implementing PBL. Helen expressed the same idea, that it was important to have a principal that will say, "If it fell apart. So what? Try something different." This supportive stance meant that teachers could implement PBL without a high level of stress or anxiety. This positive affective state was fostered school-wide. Because the principal set the tone for PBL implementation as one that was supported and low-risk, there was a culture of positivity about PBL at the school that enhanced collective efficacy. The positive emotional state created via social persuasion from administrators supported risk-taking and made a difference for these teachers in how they felt about PBL implementation.

In addition to supporting collective efficacy by creating positive affective states, the administrators at Park Middle School also became experts in PBL themselves. The expertise of the administrators served as mastery experiences for collective efficacy at the school in that teachers recognized that their school was good at PBL in part due to the expertise of their administration. Sarah, at Park Middle School, talked about how the administration "went behind this [PBL implementation] full force" and knew that they went to "conference after conference." Paul, the principal, verified the effort he and his administrative team put into PBL and explained how they approached becoming PBL experts:

> Two assistant principals, three Dean's and myself. So between the six of us, we each became an expert in one of the elements, expert being defined as if a staff member said, 'Hey, I really need help with sustained inquiry, who's the expert at the school?' They'd say, 'Sixth grade dean.' And so they [administrative team] were to research and really to become self-improved and become an expert: do research, have resources, become an expert in that element. So between the six of us from those original seven elements, really the eighth one was curriculum. We pretty much covered them all.

This public expertise of the administrators served as collective mastery experiences, that is, it provided evidence to the staff that the rest of the staff at your school is an expert in PBL. For instance, Sarah explained that "You go to a training, and they'd have an LMS page and be like, link after link after link after link of stuff that we could use to help us." The research her administrative team had done was evident to her and contributed to her sense that her school was skilled in PBL implementation. This role of the administrators as knowledgeable and supportive also served as positive social persuasion for the staff at Park Middle School. In a follow-up email, Sarah emphasized the importance of this, "they frequently checked in with us at our [PLC] meeting to ask how it was going, what we needed, how can they support us?" Having this knowledge and being supportive allowed the administrators to serve as coaches for their staff, which meant the school as a whole could approach PBL believing in their ability to be successful.

Sources of teacher self-efficacy and PBL implementation

Four themes emerged in the interviews and document analysis of Park Middle School that relate to the sources of self-efficacy (see Table 8 for examples of interview quotes and document analysis that exhibit sources of self-efficacy). In the following section I will describe

in more detail how the teachers and administrator at Park Middle School talked about these four sources of self-efficacy and how they relate to PBL implementation.

Mastery Experiences: Doing PBL and seeing the results

Mastery experiences are considered a primary source of self-efficacy and refer to past successful achievement of a task (Bandura, 1997), in this case the task is PBL implementation. Teachers at Park Middle School described mastery experiences in three different ways. Teachers described past projects that they implemented that they felt met the expectations of high quality PBL. In addition to focusing on these high-quality elements, teachers also indicated that they felt past projects were successful and examples of mastery experiences when they described positive student outcomes that were the result of the PBL. Finally, teachers at Park Middle School also described mastery experiences by reflecting on how their PBL implementation has improved over time. Below, I describe in more detail how teachers at Park Middle School described mastery experiences that enhanced their PBL implementation.

Much like in Forest High School, teachers in Park Middle School described PBL experiences that aligned with high-quality PBL. When giving details about projects they had implemented in their classes, teachers described projects that involved driving questions, student collaboration, authentic projects, student voice and choice, and were aligned to standards. For a teacher to reflect on an experience as a mastery experience, teachers must see how their implementation of PBL was a successful experience. One way teachers do this is by highlighting ways in which their projects align with what they know to be high-quality elements of PBL based on the professional learning conducted at Park Middle School. For instance, the art teacher at Park Middle School described a project in which she partnered local artists with students to make ceramic cups which were then sold at a community event to raise money for a local food pantry (Document B-9). The project demonstrated high-quality elements of PBL like authenticity (students partnered with local artists), student voice and choice (students designed and created their own cups) and opportunities for students to make their project public (cups were auctioned at a community event). As Kyra described, her project included “a community partnership because of the food pantry [involvement and] local artists as well coming in" and “we had somebody from the pantry that came and the kids did a little presentation for them.” Kyra recognized this project as a mastery experience as it matched several elements of high-quality PBL projects and this contributed to her sense of self-efficacy for PBL implementation.

Helen, a social studies teacher at Park Middle School, described a project in which students wrote a series of journal entries that reflected different periods in U.S. History that they were studying as a class, which served as a mastery experience for her. For Helen, one of the highlights of this project was the student voice and choice that was involved as well as how it aligned to the standards she was teaching. In addition to naming the content this project covered, she explained:

> It [the journal entries] could be their families, or it could be another family's, you know, that voice and choice, but they had to write that journal. And so they had to act like they were the person writing it, or the person reading it, and they had to write and they had to incorporate everything that they had learned into this journal.

Helen sees this project as a mastery experience because she knows that student voice and choice and alignment to standards are two elements of high quality PBL.

Sarah, a science teacher from Park Middle School also highlighted the importance of alignment with standards. She observed, "So I think that [PBL] has improved the kids' connection with the curriculum, so they're more interested in it, because I'm connecting things more to things that interest them. So that improves engagement, and therefore improves learning." Sarah recognized that her PBL was successful and a mastery experience because it didn't just increase the general engagement of students, it increased their engagement with the curriculum.

In addition to seeing how their projects contained high quality elements of PBL, teachers also viewed their implementation as successful if they saw positive student outcomes as a result of their PBL implementation. Reflecting on positive student outcomes also served as a way of reflecting on mastery experiences and enhancing self-efficacy. For instance, Kyra described how by incorporating student critique and revision into her PBLs, students' ability to talk about and reflect on their work improved. She shared, "by having them have that [critique and revision] it really helped them formulate to have better conversations about their processes, and just what they did, why they did with their work." Since being able to reflect on art work was an instructional goal Kyra had for her art students, seeing this outcome from PBL served as a mastery experience for her. Similarly, when describing a PBL experience in her Civics class, Helen observed how her incorporation of student collaboration positively impacted students' interpersonal skills. She explained, "it allows the kids to kind of connect with each other. And

they learned that they can rely on each other to ask questions, or 'what do you think?' you know, to get a peer review type thing?" Seeing how student collaboration can lead to positive student outcomes makes her implementation of PBL a mastery experience for Helen. Sarah talked about the importance of a public product in PBL experiences and how that positively impacted the quality of student work. When describing a project where the seventh-grade students create a model of a cell that the eighth-grade students use to review for a state test, she described how the public audience for their work improved students' work. She explained, "So then they know the eighth graders are going to be playing with their models. It's like, you know, they, they up their game." The improved level of work she saw from students as a result of her PBL indicated the success of the PBL unit. This recognition of how students were responding to PBL served as mastery experiences for these teachers.

Similar to the teachers in Forest High School, teachers at Park Middle School also shared that the more they did PBL, the more successful they felt. When asked why she thought she was successfully implementing PBL, Kyra replied "I think … just because of experience." Sarah responded in a similar way, she said, "I guess, just because of my confidence level with it, and how, you know, I kind of think in those terms now, because I've done it for so long." She added, "I've done a lot so, and practiced, and I've had a lot of mistakes and fixed those mistakes. So that's, I got some experience behind me, I guess." The opportunity to implement PBL over several years and several different projects allows teachers to reflect on past mastery experiences and recognize their growth and ability to successfully implement PBL and to believe in their own future success implementing PBL. Teachers at Park Middle School provided specific examples of high quality PBL, reflected on positive student outcomes as a result of these projects, and felt that their PBL implementation was improving each year. Each of these served as mastery experiences that enhanced their self-efficacy for PBL implementation.

Social Persuasion: Peer feedback and recognition

Bandura (1997) recognized social persuasion, getting feedback from a respected source, as one of the sources of self-efficacy. Teachers from Park Middle School talked about three sources of social persuasion as being important for their self-efficacy for PBL implementation: feedback from their peers, feedback from other schools, and official recognition of their high-quality PBL implementation at the school or district level, In each case, the feedback sent teachers the message that their PBL implementation was strong, increasing their sense of self-

efficacy. Below, I describe in detail how the teachers at Park Middle School talked about the role of social persuasion in their self-efficacy for PBL implementation.

Teachers at Park Middle School also received direct messages that their PBL implementation was high quality. These direct messages from school officials also served as social persuasion that they were successful at PBL implementation. In addition to these visits, these teachers also shared that sometimes their project was used as an example for other teachers learning PBL or that the school district created publicity for the project to share with staff and the wider community. For one of her projects, Sarah had created a website that described the project and walked students through examples (Document B10). The school district asked Sarah to share this website with other schools. Sarah commented on how this influenced her feelings about her PBL implementation, "Oh, it makes you feel pretty good, because you're being held up as an example. So that's, that's kind of good." Kyra also described how she felt she was successful at PBL, "because we have been recognized for some of our things like this project, we did a kindness project. We were recognized by our school system. They actually did a video documentation and put it out on our school news site and stuff like that." The school district created a video that highlighted how the kindness project exemplified high quality PBL and had a positive impact on students and the community (Document B7). This messaging and feedback from her school district that her project was high quality PBL and deserving of increased publicity increased Kyra's sense of self-efficacy.

In addition to this official recognition, the three teachers from Park Middle School that participated in this study all reflected on how their PBL implementation has served as a model for other teachers and how that feedback from their peers increased their self-efficacy for PBL via social persuasion. While often social persuasion looks like one teacher encouraging another to try something, like PBL, in this case, social persuasion came in the form of influencing other teachers. For instance, Helen described how she was able to convince the other two members of her PLC to implement PBL. Seeing these peers implement PBL because of her modeling provided positive feedback that what she was doing with PBL was worthwhile and worth continuing. She describes it this way:

> And so I brought [PBL] stuff to the table. And they were hesitant, a little bit, only because it was kind of unknown to them. But when I showed them what I was doing in class, and when I shared my examples, and when I shared how great and wonderful the

> kids responded to it, it was like, one of them came on board for a little bit. And then he was marching. He was doing everything I was. In our PLC it was like, "What are you doing?" I'm like, "I'm doing this." He's like, "Well, I want to do that." And the other one was like, "Well, you know, we didn't do *that*, we did *this* last year." And he's like, "Yeah, but I want to do this." So it took her probably up until Novemberish, Decemberish to kind of just throw in the towel and say, "Okay, I'm doing what you're doing." And, and so almost for four solid years, five solid years, they've been doing what I brought to the table, which is kind of nice, kind of flattering.

Helen's experience watching teachers going from being resistant to PBL to embracing PBL because of her modeling increased her efficacy in her own PBL implementation via the social persuasion she received by watching her peers respond to her own PBL implementation. Kyra was not as specific about her influence on her peers but when I asked her about how she knew she had PBL expertise, she gave an example of presenting about PBL to other Art teachers, "We actually hosted through our Art department just last month, we hosted a department activity and invited Art teachers from across our county here. And myself, my two colleagues kind of presented with that." This feedback, that other teachers wanted to come and learn about her PBL unit, served as social persuasion about her skill with PBL. Kyra could recognize through her peers' interest in how she is implementing PBL that she is skilled with PBL implementation. Sarah shared a similar sentiment in a follow-up email. While PBL felt very natural to her, she recognized that other teachers struggled with implementation, so she shared how she helped those other teachers by providing guidance and resources, "People like me also helped those for whom this type of teaching is not as comfortable by sharing ideas and materials." Sarah recognized through her interactions with her peers that she has PBL expertise that is valued and needed from her peers. While social persuasion is sometimes framed as a teacher needing encouragement for others, in this case study, these teachers found their ability to bring their PBL expertise to others served as social persuasion that they had this PBL expertise. As teachers had opportunities to share their knowledge and experiences with PBL, their efficacy increased.

In addition to being a model within their own school and school district, teachers talked about how other schools would come to visit their classrooms to see PBL in action. This encouragement and feedback from other schools also served as social persuasion. Helen talked about the fact that her classroom was one that other schools came to visit. Being a model

classroom gave her feedback that her PBL implementation was strong, “It is good to know that other people want to come and see what we're doing. Especially if they're just starting out on the PBL train, as I call it.” Sarah also mentioned that Park Middle School gets visits from the school district or other schools and mentioned, “you start to, to feel pretty confident when other schools want to learn from you.” Other schools and district officials coming to their classes to see PBL in action provides teachers with feedback and messaging that their PBL implementation is at a high level, increasing their self-efficacy for PBL implementation.

Seeking vicarious experiences

Vicarious experiences involve direct or indirect knowledge of someone you perceive to be like you completing the task you are trying to accomplish (Bandura, 1997). For PBL implementation, teachers may have the opportunity to observe other teachers implementing PBL which can serve as a vicarious experience for them. Knowledge that others at your school can implement PBL can increase your self-efficacy for PBL implementation. Teachers at Park Middle School spoke generally about seeing PBL in action around their school and from teachers at other schools in their district. And while none of the participants from Park Middle School described someone specific that served as a peer model for them, they did describe learning about other projects as being helpful. For instance, Kyra described visiting other teachers’ classrooms during a professional development day and finding new things to try with PBL. She reflected, “[I would think] ‘That's so amazing. Never thought about that.’ I think there's always something you're walking away with.” Kyra further emphasized this point in a follow-up email saying, “Everyone needs inspiration. I love learning from my fellow educators.” Having the opportunity to learn about other’s PBL work through these vicarious experiences gave her new ideas about how to continue with her own PBL implementation. Sarah talked about how she gets information about other projects at her school when the project requires cooperation from the rest of the school:

> Because they have to involve the whole school, sometimes they're getting information from the students or from the teachers or something. So you get like, ‘Oh math is doing a PBL on this. Can you get all your students to fill out this Google form?’ You know, so they can collect data and they can use the data.

In a follow-up email she clarified the importance of these models, “even if the projects other teachers were sharing were not applicable to my curriculum, seeing HOW they accomplished

different elements was invaluable. Especially because they were my colleagues, and their solutions were realistic and doable." Having the opportunity to learn about other projects served as vicarious experiences for Sarah, increasing her self-efficacy for PBL implementation. Helen shared that she feels that learning from a peer is better than professional development to build someone's efficacy for PBL implementation. "I really believe you need, you need someone, if you're new to PBL, you need to have a mentor buddy to walk with you through the process and not just look in a book and say 'Here's PBL. Learn.'" While none of the teachers at Park Middle School specifically said that seeing other teachers implement PBL meant that they believed in their own ability to implement PBL, teachers at Park Middle School did seem to feel that learning from their peers was helpful for their own implementation of PBL and likely indirectly contributed to their self-efficacy.

Positive Affective States: Enjoying PBL and feeling aligned to the work

Teachers in Park Middle School were similar to teachers in Forest High School in that they often expressed positive affective states when describing implementing PBL. While teachers didn't describe specific physiological symptoms like quickened heart rate or sweaty palms, they did use expressions of positivity that indicated positive emotional states about PBL implementation. Sarah said both "I love teaching project-based learning" and described a project as "it's a lot, that was a lot of fun." Helen describe a project as "a blast" and referred to a deep connection with the importance of PBL by describing what she sees as central to PBL:

> They're making those connections. And that's, that's part of the big thing about PBL, in my heart, is making a connection outside of the content, like, like, here's the content, it doesn't stay in a box. It's real, you know, especially civics, it's real. So we use real examples.

The principal, Paul, also expressed how great he felt when he felt the school was doing PBL at a consistently high level, "we were at the top of pinnacle, I felt things were fantastic." While some teachers describe the stress associated with teaching or other negative emotional states, teachers at Park Middle School had very positive emotions to report in regards to PBL implementation.

These positive feelings also seemed to stem from a place of personal conviction about PBL as a style of teaching. While these next quotes do not specifically discuss emotions or physical symptoms of positive or negative emotions, they do reflect an inner sense that PBL is how they should be or were meant to be teaching. This resonance of their own beliefs about

teaching with the way they are teaching when implementing PBL created a positive emotional state in that teachers weren't conflicted between their personal beliefs and the way they were teaching. Consider that when teachers are asked to teach in a manner in conflict with their beliefs, it can cause stress and burnout. These teachers were reporting instead a consonance that provided positive affective states. Sarah described her alignment with PBL this way, "I think I'm more student-centered. You know, I never was a 'sage on the stage' teacher, you know, that was never my style. So it [PBL] fit very well for me." In a follow-up email, Sarah added that "When I have a whole class moving around, actively learning and engaged in what they are doing, I feel like I have done my job. Because PBL came naturally to me, implementation was something I was excited about and creating the PBL experiences was fun." Helen compared implementing PBL to three other styles of teaching (lecturing, projects with no scaffolds, projects with scaffolds but no teacher support), "I've done that. I've been all three of those people. And I didn't like them. You know, the one I like is the one I'm doing where I'm supporting, I'm helping, I'm nurturing, you know, giving them successful, you know, supports." Helen also described her reaction when other members of her PLC were "doing packets" instead of PBL. She explained, "it just made me cringe." In a follow-up email, Kyra talked about the importance of enjoying implementing PBL, "When you love what you do it just flows." Furthermore, when asked in a follow-up email what had the most influence on encouraging them to implement PBL, Sarah and Kyra both cite their enjoyment of implementing PBL as the primary reason they implement PBL. For these teachers, being able to teach in a style that matched their own sense of what teaching should be, allowed them to stay in a positive emotional state while implementing PBL. This positive affective state served to enhance their self-efficacy for PBL implementation.

Challenges to PBL efficacy at Park Middle School

While self- and collective efficacy for PBL implementation was high for the staff that participated in this study, there were some indications that the school was not implementing PBL at the same level it had been before the COVID-19 pandemic. Park Middle School had redefined PBL after the COVID pandemic to make it more amenable to teachers on the return to in-person teaching. This redefinition had implications for the role of mastery experiences for collective efficacy. There was also a sense that the support from the school district might be shifting as the school district took on multiple priorities. This misalignment impacted both social persuasion and affective states in that it was unclear if PBL was supported by the school district. In the

following section I will go into more detail about how these two factors influenced the level of collective efficacy at Park Middle School.

Redefinition of PBL

While the staff that participated in this study were overall excited about the level of PBL implementation happening in their classrooms and at their school, they also felt that the level of PBL implementation was lower than before the COVID-19 pandemic. Kyra expressed this well, "I think that prior to COVID, there was a lot more going on school-wide. I think it's kind of shrunk into smaller moments now, which I think is okay." Helen qualified it this way, "if you would give us an overall score, I would say we're over half doing PBLs at any at any point, you could come in and find all of us doing at least parts or pieces of a PBL." One way Park Middle School was adapting to the changes to school post-pandemic was to use what is called a "dimmer switch" approach to PBL (Kamps, 2021). Instead of thinking of PBL as all or nothing, teachers were encouraged to think of PBL as on a continuum. Teachers might slide the dimmer switch up for PBL by implementing a learning experience that included most of the high-quality PBL design elements but that it was also acceptable for teachers to lower the dimmer switch and only highlight one design element at a time. In addition to using this "dimmer switch" approach, the principal called the use of PBL "experiences" instead of projects. He believed that this terminology helped PBL seem less overwhelming:

> Instead of calling it a project, which implies a longer-term commitment, and scares teachers, we call them experiences. So an experience could be a one-day experience or a three-day experience. You know, use that driving question to have an experience using the elements [of PBL].

While Park Middle School felt that their level of PBL implementation had changed since the COVID-19 pandemic, there was a sense that switching to "experiences" instead of "projects" and using a "dimmer switch" approach was a good way to continue to implement PBL while accommodating the changes to schooling that had taken place. However, this redefinition had implications for mastery experiences. If teachers felt that PBL implementation should look and feel a certain way and if they felt like the current "dimmer switch" and "experience" approach wasn't meeting that bar, that could lower their collective efficacy for PBL implementation.

Changing alignment with school district priorities

Another issue with efficacy for PBL implementation at Park Middle School related to the growing misalignment of PBL with school district priorities. While some of the teachers at Park Middle School indicated that PBL implementation was supported by their school district, the principal and other teachers felt that the district had numerous and competing priorities that made focusing on PBL as a school difficult. Sarah noticed that the school district had multiple priorities (PBL and personalized learning) and it was her principal that kept the focus on PBL at her school, "so I know our principal, really, I think he gravitated towards project-based learning. And he felt it was too much to put on the staff to say here, learn all this project-based learning and learn all this personalized learning." Paul, the school principal, agreed that the school district had multiple priorities and that this made his ability to focus on PBL challenging:

> It was a little more difficult. When we had a new superintendent, they were really emphasizing personalized learning. Then the county also emphasized mental health last year and then this year they said we're going to have a return to rigor. And so now the county is very focused on data and how we're going to regain the lost years from everybody. And it's more difficult to accomplish PBL because there's more of an emphasis, countywide, on scores and small group intervention.

Document B2 supports Paul's perception and lists multiple significant pedagogical approaches as priorities for the district. These multiple priorities created less clarity for Paul about whether or not his school's work on PBL was valued by the school district. This lack of clarity lowered collective efficacy via social persuasion because feedback from his supervisors was not focused on PBL. Paul recognized that this could also lower efficacy for his staff and he took steps to shield teachers from this and saw his role as principal "to protect them [staff] from any central office overreach." Paul continued that as an experienced principal, he felt like he could resist the pressure from the school district to try to implement multiple priorities but worried about other principals that were newer, "they don't realize the impact it [multiple priorities] has on staff morale, staff, workload, staff inconsistency, student inconsistency, it's very difficult." At Park Middle School there was some understanding that the school district did support PBL but there was also concern that the school district had multiple priorities. This uncertainty about the degree to which the school district supports PBL exclusively is a challenge for Park Middle School that influenced both social persuasion and affective states for PBL implementation.

Summary of Park Middle School, sources of self- and collective efficacy, and PBL implementation

Park Middle School has accomplished a great deal in terms of developing self- and collective efficacy for PBL implementation in the last five years despite the challenges of the COVID-19 pandemic and shifting district priorities. Several strategies that related to multiple sources of self- and collective efficacy helped develop the high level of self- and collective efficacy at Park Middle School for PBL implementation. The clear expectations set at Park Middle School based on high-quality elements of PBL such as authenticity, student voice and choice, driving questions, and public products helped teachers recognize mastery experiences in their own PBL implementation and in their peers. Opportunities to learn about other teachers' PBL implementation in PLCs and in professional learning provided vicarious experiences that also enhanced self- and collective efficacy. Park Middle School also used structures like PLCs (or CLTs at Park) which served as a source of social persuasion for many teachers, providing feedback and encouragement. Much like Forest High School, teachers at Park Middle School also talked about the positive affective states that existed at Park Middle School in regards to PBL implementation. A warm, supportive and knowledgeable principal meant that teachers felt they could take risks with PBL and that when they needed support, they could go to their principal. This resulted in teachers feeling excited to implement their PBL ideas rather than feeling pressured or stressed about PBL. Teachers at Park Middle School found joy in PBL implementation and saw PBL as aligned with their own skills and beliefs. Being able to enact a style of teaching that felt consonant with their own skills and beliefs enhanced teachers' self-efficacy for PBL by fostering positive affective states during PBL implementation. Park Middle School also faced some challenges in terms of efficacy for PBL implementation. While Park Middle School initially was fully supported by the school district in PBL implementation, the district has since taken on additional initiatives and it is unclear if their support of PBL will continue. In addition, to accommodate the upheaval of the COVID-19 pandemic, virtual, and hybrid learning, Park Middle School focused more on "PBL experiences" rather than full projects. This focus on specific high-quality elements of PBL rather than on full implementation in which many elements work together, may lower collective efficacy for PBL implementation by creating different levels of implementation. Park Middle School has many structures and elements that can continue to foster high self- and collective efficacy for PBL implementation.

Profile of Orchard Middle School

Orchard Middle School is a public middle school in a large school district that serves over 1,000 students in grades 6-8. A majority of students at Orchard Middle School are African-American (60.9%) and the majority of the rest of the student population is Hispanic (25.5%). See Tables 2 and 3 for more detailed demographic information. Orchard Middle School students are economically disadvantaged (100%) and scored below the state average on reading and math assessments in the 2021-2022 school year. Orchard Middle School is the newest to PBL of the three schools presented in this multiple case study. It was named a "PBL" school by the school district in 2019-2020 (Document C-9). This designation came as part of a larger initiative by the school district to address academic and social-emotional needs of middle school students (Document C-2). Although 2019-2020 was the first year at Orchard Middle School for the current principal, she came with prior administrative experience. To launch PBL teachers attended professional development that was facilitated by an outside organization and was offered across the school district during the summer of 2019. During the school year, teachers looked for opportunities to incorporate PBL into their classroom teaching. The COVID-19 pandemic disrupted both the professional development efforts and classroom implementation during the 2019-20 school year. However, beginning in the 2021-2022 school year, Orchard Middle School began a school-wide PBL program. School-wide PBL at Orchard Middle School involved projects designed by the administrators and a teacher leadership team. The leadership team begins planning in the summer and develops a central project. Different aspects of the project are implemented in the four core areas (English Language Arts, Math, Science, Social Studies). Projects differ by grade level with different driving questions for each grade level. Students present their final projects at a student showcase in the spring. Beginning in the 2022-2023 school year, Orchard Middle School expanded the PBL implementation to two school-wide projects, one in the fall and one in the spring. This method of implementing PBL continued into 2023-2024. Orchard Middle School's website declares "We are a STEM Magnet School where students are immersed in Project Based Learning!" (Document C-4). The principal explains the role of PBL at Orchard Middle School in an executive summary, "Using a problem and project-based learning approach, students will use a combination of analysis, discovery, problem solving, communication, and creativity to attain 21st century skills that will allow them to be empowered lifelong learners and responsible citizens" (Document C-1). When asked to rank

themselves on a scale from 1 to 10, with 1 indicating that they are just starting to learn about PBL and 10 indicating that they are an award-winning PBL teacher, responses ranged from a 5 to an 8 (mean = 6.75, *n*=4). Orchard Middle School is located in a politically charged state where the role of education is being heavily challenged. Families can choose to enroll their students in different schools across the county and in charter schools. This is a concern for Orchard Middle School which saw their enrollment drop for the 2022-2023 school year. The principal at Orchard Middle School, Sophia, hopes that embracing PBL will help make their school stand out. As she stated:

> You know, I made it clear that we've got to do something different, because we got to keep our kids and still be able to recruit kids to come to public school now that we have a governor who's given vouchers to everybody.

In the following sections, I will first describe three themes that supported collective efficacy for PBL implementation at Orchard Middle School. After discussing these themes related to collective efficacy, I will explore two themes that relate to sources of self-efficacy for PBL implementation for the teachers at Orchard Middle School. Finally, I will discuss challenges to collective efficacy for PBL implementation at Orchard Middle School and how these relate to the sources of collective efficacy.

Sources of collective efficacy for PBL implementation

Orchard Middle School supports the sources of collective efficacy in multiple ways. Collective efficacy refers to the sense that the school "as a whole" is implementing PBL successfully. Three themes emerged at Orchard Middle School that relate to the four sources of collective efficacy: mastery experiences, vicarious experiences, social persuasion, and affective states (see Table 9 for examples of interview quotes and document analysis that exhibit sources of collective efficacy). For each theme I will present a figure showing how different sources of collective efficacy relate to that theme as well as provide examples from the teacher interviews showing how these themes relate to collective efficacy.

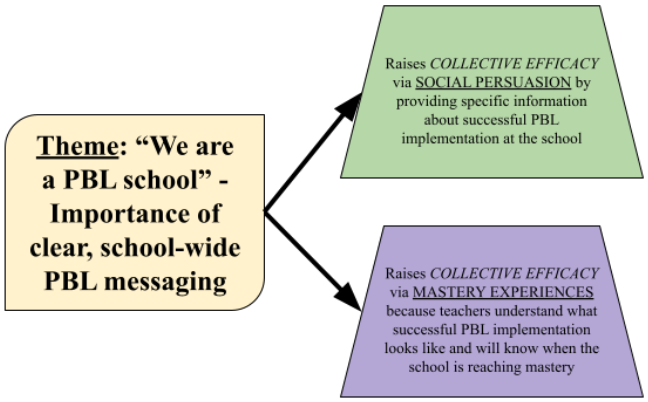
"We are a PBL school" importance of clear, school-wide messaging for PBL

When it comes to collective efficacy, teachers take into account how well their staff, as a whole, implements PBL. At Orchard Middle School, one way teachers talked about how they knew that the staff, as a whole, implemented PBL was the acknowledgement that Orchard Middle School is a "PBL school." This theme, "We are a PBL school," came up again and again

and was tied closely with "clear, school-wide messaging" about PBL. This theme relates to two key sources of collective efficacy: mastery experiences and social persuasion which I will describe in further detail below.

Figure 8

Relationship of theme "'We are a PBL school' - Importance of clear, school-wide PBL messaging" with sources of collective efficacy for Orchard Middle School



Mastery experience is one of the most influential sources of collective efficacy. When it comes to mastery experiences for PBL school-wide implementation, teachers know that their school is successful at PBL if that their school identifies as a PBL school. The fact that all the participants from Orchard Middle School used this label when describing their school indicates that they believe that their school does enough PBL to earn this title. Teachers described that their school is a Science, Technology, Engineering and Math (STEM) and PBL school. When asked to describe his school, Lou said, "Here at Orchard Middle School, we are a STEM-PBL school as well. So we integrate STEM into everything we do. And we integrate project-based learning into everything that we do. And we do project-based learning every year." Similarly, in describing her school Leona said, "we're a STEM school. And we have to, you know, conduct these PBLs." She went even further to say "we really go all out for our PBLs." Dan agreed with Leona and Lou stating, "That's pretty much where we stand in our PBLs, we're pretty intense at our school." In addition to using this label, two of the teachers that had been at Orchard Middle School longer, Dan (14 years) and Lou (8 years), discussed that the school had improved in their PBL implementation and had faith that this would continue into the 2022-2023 school year. Lou explained, "We've started to implement more and more every year. So naturally, you just get better at it. You just get better at it." Lou added how by teachers getting better and better at PBL,

it made implementing PBL easier, “Now that it's a lot more mainstreamed and most teachers are more comfortable with it, it is definitely easier.” This ability to reflect on the staff’s improvement in their implementation of PBL indicates that these teachers view this improvement as examples of mastery experiences and believe that their school is successful at PBL implementation. Dan indicated his belief in the collective efficacy of his school with PBL implementation by predicting successful student products, “I'm sure we're gonna get some really good projects.” Dan recognized that one way to interpret school-wide mastery experiences for PBL implementation was through student outcomes – that evidence of mastery was in the products that students produced as a result of the PBL being implemented. Predicting the success of the students at the showcase exemplifies Dan’s belief in his school’s ability to implement PBL. One indication of mastery experiences at Orchard Middle School is that teachers embrace their school as a PBL school and describe that the staff and students produce quality projects.

Part of deciding that PBL implementation at the school is being done successfully, and is therefore a mastery experience, requires staff members to understand what the project entails and that teachers are meeting these expectations. All the staff members interviewed from Orchard Middle School were able to explain what past projects entailed and what was being expected for the current project. For instance, Lou was able to describe generally how PBL is implemented at Orchard Middle School:

> And so now every year, we have one to two school-wide PBLs that aligned with STEM science, technology, engineering, and math. And we collaborate together as a school, specifically the department chairs and the coaches collaborate, to plan and implement these school-wide PBLs.

Betty described last year’s project like this:

> Last year, we did one project-based learning required assignments for the entire school, based on the grade level was a different topic. I know sixth grade did something on prosthetics. I can't recall what seventh grade did, eighth grade did concussions based on sports, school sports. So we did that.

Teachers at Orchard Middle School were also confident that most teachers were implementing PBL in some way. Leona shared “it’s school wide” describing each department’s role:

> When they go to math, they understand that they may have to deal with a budget, when they go into social studies, they may have to create the community or create something

> that goes along with the with that particular project. Even the elective teachers, they helped with the project as well.

Dan echoed this statement, bringing in the art and World Language department as well, “I mean, even the art department is involved. And I asked the Spanish teacher to translate and do some of them in Spanish. So I mean, everybody's, everyone's involved.” While Cecile didn’t give specific examples, she also believed that all teachers are involved in the PBL activities, “the entire school will have to do different pieces, because we're going to Mars [for the next PBL project].” In addition to the general mastery experiences of being a “PBL school,” teachers at Orchard Middle School know specifically what their peers are doing to successfully implement the school-wide PBL projects. This knowledge provides a sense of mastery for the teachers that their whole school implements PBL.

Part of why teachers at Orchard Middle School know PBL implementation is happening school-wide is the clear, consistent expectations laid out by the administration and her leadership team. The clear and consistent messaging from the school leadership provides social persuasion for the teachers about what is expected and how to meet those expectations, and provides the materials for doing so. Orchard Middle School specifically lays out what each department needs to do for the school-wide PBL. Dan, who is part of the leadership team, described how teachers are involved, “All the disciplines. And we actually said, ‘Okay, math, this is what you're supposed to do. Language Arts, this is what you're supposed to do.’ So as you go through, everybody has a part, and then they put it together.” Lou talks about how in his department the tasks are assigned but teachers have some freedom to decide which days to implement PBL:

> We left it up to teachers to plan, okay, you have between 8-22 and 8-26, to do your introduction and vocabulary. So if they want to do that on Monday, or Tuesday or Friday, that's fine. But between those dates, this is what you have to get done. So teachers had to kind of plan it out specifically how they wanted to incorporate everything.

Document C-6 is an example of a project plan that provides each department the specifics of their project and links to student rubrics as well. This project plan is further evidence of the clear messaging and the curricular supports that provide social persuasion to the teachers at Orchard Middle School. Betty agrees that the expectations are clearly laid out:

> They tell you that you must devote at least one day a week to the PBL. They mandate it in order to make sure it happens... They make sure every department knows what they're

> doing every grade level. They manage, you know, how it's being done and what's being done in the topic that they are responsible for.

Leona also felt the same way, “it was kind of laid out for us. We just had to make sure that the kids were doing their assignment.” She went on to say, “Yeah, all of the information [PBL calendar and rubrics]. It was given out pre-planning, and they sent an email as well.” Leona feels supported by the resources and the clear messaging about PBL. Cecile was the only teacher that didn’t feel confident in what the expectations were, “I don't understand sometimes what they want and what is expected.” As Cecile was new to Orchard Middle School in 2022-2023, this could be that she hasn’t had the same training or support as the other teachers. In addition to the direct influence this social persuasion had on teachers at Orchard Middle School to enhance collective efficacy, it also served to enhance the mastery experiences of teachers. By seeing the instructions not just for themselves but for the whole staff, they were encouraged to continue with their implementation knowing that their school implements PBL successfully.

School-wide PLC routines and protocols

A second theme that relates to the sources of collective efficacy in Orchard Middle School is the use of “school-wide routines and procedures” that support PBL implementation. In the case of Orchard Middle School, the use of professional learning communities (PLCs) were supportive for the development of collective efficacy for PBL implementation at Orchard Middle School. These “school-wide routines and procedures” developed multiple sources of collective efficacy: mastery experiences, social persuasion, and positive affective states. In this section, I will explore how “school-wide routines and procedures” helped to develop collective efficacy via mastery experiences, social persuasion and affective states.

PLCs are a central component to how school-wide PBL is run at Orchard Middle School. Once the leadership team has developed the plan for the PBL and what each department is responsible for, the PLCs discuss the requirements as a team. This process serves multiple sources of collective efficacy. By working with a group of teachers that will all be implementing one specific part of the PBL, teachers gain mastery experiences that the school as a whole is implementing PBL. Lou describes how he knows his peers are implementing their part of the project and can then share resources to make implementing PBL easier:

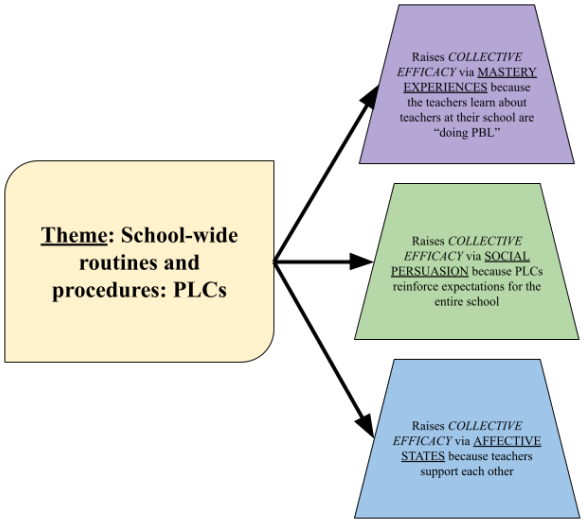
> And in most of the times our PBL projects, each of the civics teachers or each of the social studies teachers will have the same aspect. Right? So currently, we're doing the

STEM project on STEM careers. And all of the social studies teachers' job are to have our students research what education is needed for the different STEM careers that the students are choosing. So I can get together with my other social studies teachers and be like, “Okay, what resources are you guys using? How are your students researching? What are you using, a specific graphic organizer?” So it's a little bit easier to plan in our content area.

Working regularly with other teachers that are also engaged in the PBL works reinforces that PBL is implemented widely at Orchard Middle School, which serves as mastery experiences for collective efficacy.

Figure 9

Relationship of theme “School-wide routines and procedures: PLCs” with sources of collective efficacy for Orchard Middle School



In addition to serving as a source of mastery experiences, meeting as a PLC also provides social persuasion. PLCs serve as a place where teachers encourage each other in their PBL implementation and school leadership checks in to see that teachers are on track with their implementation. This check-in space for teachers to get encouragement from peers and leadership serves as social persuasion, supporting collective efficacy for PBL implementation. Lou describes it like this, “We can really, every week, we can talk about like, if we're implementing a PBL, we can talk about where we are at and what we need to get done. So it's, I like it that way.” The PLCs at Orchard Middle School also serve as the mechanism for the administration to check in on how the projects are going and to reinforce expectations. This also

provides social persuasion that builds collective efficacy in that these check-ins from school leadership keep the teachers clear on what they need to do to be successful. Cecile explains:

> The person in charge of the planning, the science department, they will come into our PLCs and you know, make sure that we understand what we're to do, and how our department chair will have updates. “Where are you? What's going on? What do you need?”

Leona mentioned how these kept her PLC on track, “we also had a lot of PLCs to kind of guide us as well. Make sure we had like checkpoints, you all should be here, you all should be there.” Document C8 which was a copy of a PLC agenda shows a specific item to remind the members of the PLC “that Milestone #4 and Milestone #5 should be completed.” Thus PLCs provide social persuasion for collective efficacy through messaging from peers that they are all implementing the PBL unit and the oversight from school leadership that teachers are on track with their PBL implementation.

Finally, PLCs can also help to provide a supportive community that helps lower stress and create positive affective states for the teachers around PBL implementation. Cecile specifically discussed how “my teammates, my ELA teachers are in my level, my grade level, have been more supportive, because we just rely on each other and like, we're like, we got to get this [PBL] done.” Lou also shared that he found his PLC useful because they can “lean on one another.” Having a PLC to work with provided more support, creating less stress for teachers as they implement PBL.

Approachable and supportive administrator

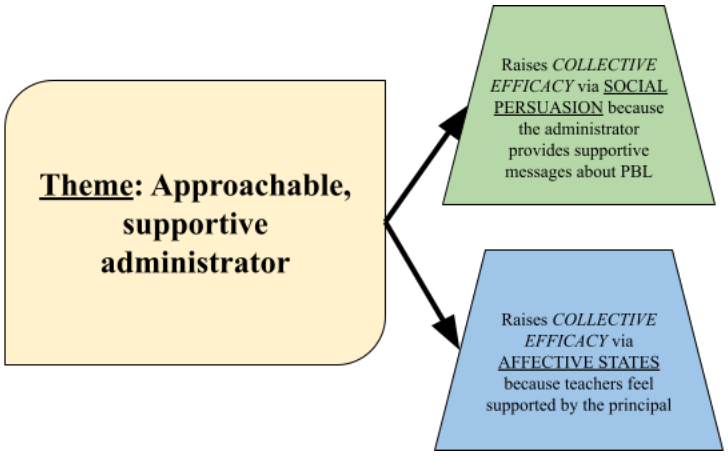
A third theme that played an important role in the development of collective efficacy for PBL implementation at Orchard Middle School was that of an “approachable, supportive administrator.” By being “approachable” and “supportive,” Sophia, the principal at Orchard Middle School, helped to support positive affective states in the staff and provide social persuasion that she supports PBL implementation and that it was going well as a school. In this next section I will describe how teachers described Sophia and how her approach to leadership enhanced collective efficacy for PBL implementation.

Sophia, the principal at Orchard Middle School was described by all the teachers as being approachable and supportive of PBL. By being both approachable and supportive, the principal helped to develop collective efficacy for PBL. Specifically, her approachability allowed teachers

to feel that she was open to feedback about what was needed to be successful with PBL, which helped to keep stress low at the school, fostering positive affective states. Betty talked about how Sophia, the principal, "is always approachable. The doors are always open, my principal gets down and dirty with all of us. So no, I'm very pleased with the support." By seeing the principal as approachable, Betty feels more at ease. Leona shared the same perspective, "Admin really has your back and they're open. So you're able to, you know, express to them how you feel about things, whether it's positive or negative, and you don't get like pushback from them. So it's a great working environment." Leona was saying that this ability to give her opinion and feel that she is heard makes the school a positive atmosphere, one where teachers' voices are heard. Lou got even more personal is his description of the importance of the support of the administrators, "I'm also very close with my administrators as well. I've always felt very welcomed here. I've always felt very really wanted here." The sense of belonging Lou conveys also fosters the positive affective states that helps to develop collective efficacy. Sophia herself was also aware of the importance of being an approachable administrator. She discussed trying to strike a balance in encouraging PBL without creating backlash, "as a principal, you know, you want to push project-based learning because you know how important it is, but at the same time, you also want people to not run away with their hair on fire, you know, so stressed out." She recognized that she needed to be gentle in her approach to PBL to maintain positivity in her staff. Her ability to support PBL while being approachable helped her staff feel good about their PBL implementation.

Figure 10

Relationship of theme "Approachable, supportive administrator" with sources of collective efficacy for Orchard Middle School



Sophia's support of PBL was also important for collective efficacy by serving as social persuasion, sending consistent messages that it was important for teachers to continue to implement PBL. Teachers at Orchard Middle School felt certain that their administration supported the PBL work and wanted them to complete the lessons. Cecile stated, "she supports it [PBL]. And overall, she's supporting. And she's supporting every aspect of it, of the school and the project." This clear support provides social persuasion that the school is implementing PBL and that the administration supports that and expects that. Leona agreed that "They love it. Admin loves PBL. They love it." She goes on to say that in addition to loving it, the expectation is clear that teachers need to do it:

> I mean, the expectation is, they [teachers] have to do it [PBL] in the class, they have to do it. So admin knows that we have different state testing and different district testing. They understand it, they know that but they still want the kids to be exposed to project-based learning.

Leona recognizes that the administrators are aware of other requirements teachers face but are clear that PBL is also a requirement. This clear support provides social persuasion that the school is implementing PBL in a manner consistent with the principal's expectations. Sophia describes her role this way:

> So my job is to make sure that teachers have what they need both material-wise, and pedagogy so that they can be successful with the kids in terms of how they teach, what they teach the content, strategies, the right strategies to keep kids engaged and things like that.

The combination of her approachability and support of PBL helps teachers feel confident and comfortable with implementing PBL by both providing social persuasion and a positive school culture that results in positive affective states among the staff.

Sources of self-efficacy and PBL implementation

In terms of self-efficacy and PBL implementation, two themes emerged in how teachers at Orchard Middle School mainly talked about sources of self-efficacy. These themes related to mastery experiences and social persuasion (see Table 9 for examples of interview quotes and document analysis that exhibit sources of self-efficacy). In the following section I will go into detail about how teachers thought about the importance of each of these sources of self-efficacy.

Mastery experiences: "Doing PBL" and seeing the results

Mastery experiences are considered the strongest source for self-efficacy (Bandura, 1997). In Orchard Middle School, teachers shared several ways they considered their past implementation of PBL to be mastery experiences. In the following section I will describe how teachers talked about both their mastery experiences and their non-mastery experiences implementing PBL.

At Orchard Middle School, the experience of completing PBL units in the past served as a source for many teachers' self-efficacy. Teachers discussed how repeated opportunities to implement PBL improved their ability to implement PBL and allowed them to see their own progress through these mastery experiences. Betty shared, "I found that I got better and better at it, over the years." She elaborated when thinking about what would give other teachers more confidence in their PBL implementation:

> I think they [other teachers] just need more experience with it [PBL], I think once you start to work with it. And they start to see how the kids get more engaged… they'll find it easier to teach, they'll see that children are walking away with knowledge, not even realizing that they're learning. Which is great. Yeah, experience.

Leona also shared that it was by implementing PBL that she got better at it. She specifically mentioned how PBL can seem overwhelming but by engaging with the practices, she found a rhythm, "so it's, it's, it's a lot at first, but once you start to get into it, and you understand, you know how to set up the rubrics and how to kind of guide the kids. It makes it flow." Being able to experience flow served as a mastery experience for Leona. Cecile, a teacher new to Orchard Middle School the prior year, shared how she is improving with more opportunities to implement PBL, "So as I go along, I'm learning how to embrace the project, and turn it into the lessons that the kids will still meet the standards." Lou also talked about how sometimes PBL can be challenging but that he found that if he kept with it, his work improved. When asked about projects that didn't go as planned, he shared, "that does happen. I'm not going to say it doesn't happen because you gotta find a way to push through. And usually it gets better. Usually it gets better." This same sentiment was shared in a blog post about PBL implementation at Orchard Middle School. The district coordinator, who authored this blog post during the second year of PBL implementation at Orchard Middle School, shared "Teachers continue to improve their implementation of PBL over time and refine their practice. Teachers' learning about PBL is

deepening over time" (rephrased from Document C3 to protect anonymity of Orchard Middle School). Teachers at Orchard Middle School use their past experiences implementing PBL to help them to improve in their implementation of PBL. This evidence of growth in their implementation serves as a mastery experience.

It is important when considering mastery experiences to understand how a teacher is deciding that a past experience is an example of mastery. For PBL at Orchard Middle School, teachers often pointed to student outcomes as how they decided if the past experience was an example of mastery or not. Betty focused on the high level of enjoyment and pride her students had with PBL and some of the skills they developed as the result of the project. When asked how she knew she was successful with PBL she focused on the pride students felt about their final product:

> they're so proud to show, like, these PSAs [public service announcements], they were proud of them. They were proud to show their peers, when I showcase them at the end of the unit. They were glowing. And they were telling people about it. You know, they're telling their parents, "This is ours, this ours."

She also pointed out the skills students developed creating the final product and how the outcome was the result of many different skills coming together. She felt it was important to point out:

> How much work it is, you know. When you just watch something you don't take into account the research and the writing and the graphics and all these things that they had to consider to put it all together. And the background, and the special effects. People don't realize that that was all chosen by the children. That was all done, they produced a PSA.

Dan shared very similar sentiments. He also shared the enjoyment students had and the pride they took in their final project when describing a project he'd implemented at a prior school:

> We produced a product, the actual model of the house, brochure of the house. They looked at the geology where they're going to build a house, things like that. So that was a project that we did. And it was really good because the end product was amazing for middle school eighth grade kids.

When discussing how he knew the school-wide PBL was impactful for students, he offered, "I'll tell you, when you watch a kid do a presentation. And they had so much fun doing it… the kids are having fun showing their stuff. Then I think that's what it's all about." Leona shared some of

the skills she sees students developing from her PBL implementations, “They're able to, you know, really collaborate with their peers to really gain knowledge. And they also can be creative. So it brings that part out of them, you know, this sparks their interest with projects.” Cecile focused on the student enthusiasm for past projects, “they were, they were excited. They wanted, some kids opted to do the physical booklet. And they were enjoying, putting their stuff together. They loved it.” Sophia the principal had the same observation about what made the teachers feel successful with PBL, “As a teacher, I think what you most want to see is your kids engaged and excited about what they're learning and getting into it. And you know, that's what we're doing.” Teachers at Orchard Middle School defined mastery experiences by reflecting on student outcomes: students expressing enjoyment of the projects and demonstrating skills acquired during the project.

While Lou also shared that student excitement with projects indicate that his PBL implementation is successful, “they get excited, they get excited to learn, they get excited to do these hands-on projects,” he also qualified his self-efficacy by saying he hasn’t had formal training in PBL and that sometimes he is unsatisfied with the student outcomes in projects. Lou rated himself a 7 [out of 10] for PBL implementation and explained the rating by saying, “Because I haven't had that formal training on it [PBL]. Yeah, I mean, I've put one together, I've implemented a few of them. So I have the experience with it. But I think I would definitely, it would help to get that formal training on it, for sure.” Lou did not feel that he had achieved cognitive mastery experiences, that is, the knowledge and skills necessary to successfully implement PBL. Professional development can serve as a source of cognitive mastery experiences in that by learning about a new practice like PBL teachers gain mastery when they feel like they have the knowledge and skills to implement PBL. Because Lou didn’t have extensive training, he felt his self-efficacy was lower because he lacked cognitive mastery experiences of participating in PBL professional development. Lou went on to say that he also gave himself a 7 (and not a 10) because of his dissatisfaction with the student outcomes of a project:

> Definitely how my students did, we started to see a trend where they were all the groups were kind of doing the same things in terms of their final in terms of their terms of their final product, I need a little bit more help with, okay, how can we really make a good

> final product out of this, instead of a child putting together you know, a PowerPoint presentation where they're just reading off the slide.

Lou's reflection, recognizing that the student outcomes were not as good as he thought they could be, meant that this implementation of PBL was mixed in how it influenced his self-efficacy. While he felt that completing the project was an accomplishment, his disappointment in the student outcomes meant that he did not fully feel that this experience had been an example of a mastery experience. Lou's descriptions serve as a reminder that "doing PBL" can also serve as a non-mastery experience in that depending how a teacher interprets the student outcomes or their own knowledge about PBL, their self-efficacy may be lowered by their experiences.

For the majority of the teachers that participated in this study, they described their past experiences implementing PBL as mastery experiences, noting especially their improvement over time implementing PBL. By recognizing this improvement, their self-efficacy for PBL implementation was enhanced. Furthermore, when teachers could observe positive student outcomes that came as a result of PBL implementation, this further enhanced their mastery experiences as many teachers described student outcomes as the basis for how they decided if their PBL implementation was successful or not.

Social persuasion: Peer feedback, administrative feedback, and getting recognition

Social persuasion, getting feedback from a respected source, has also been found to be influential as a source of self-efficacy (Bandura, 1997). At Orchard Middle School, social persuasion about PBL implementation surfaced in three ways: peer and student feedback, administrative oversight, and outside recognition. In the following section I will describe each of these in more detail.

In terms of encouragement from coaches, peers, and students, Lou talked about how encouragement from a district level coach helped him gain confidence to implement a PBL he created, "I've had her [district coach] come in and help me implement." Having a coach come in and give direct feedback served as social persuasion for Lou to help him believe in his ability to implement this new PBL unit he wrote. Sophia, the principal shared how she felt this coaching, from a district lead or a teacher leader was helpful for teachers that were struggling to implement PBL, "both coaching, my leadership team in terms of math coach, literacy coach, social studies department chair, science department chair, they all pitch in and work with the teachers who are struggling." She explained that she feels encouragement from coaches is better than from

administrators. She felt coaches were better positioned to provide social persuasion by encouraging teachers that they could be successful implementing PBL. She stated:

> It's better to have the teacher leaders step in or other teacher colleagues to step in, who are not intimidated by it and can go, "Hey, you know, I get what you're doing. Let me show you or let me help you implement and do a better job."

In addition to encouragement from coaches and teacher leaders, some teachers felt encouraged by feedback from their students. Betty shared that the feedback from the students is what encourages her to keep implementing PBL, "I get feedback from the children, which is the most rewarding, they feel good about it. They tell me that was so much fun, I thought it would be I thought I would hate it. But I love it." This social persuasion from her students gave Betty confidence that her ability to implement PBL was strong. Cecile and Lou also talked about getting encouragement from their PLCs. Cecile shared how a colleague helped her when she was feeling discouraged, "I was like, 'I don't want to do it. I did my parts. Nobody else is doing their part.' And then she was like, 'You have to remember that that's the whole mandate of the school.'" This encouragement from her peer helped her refocus on the project. Lou shared how because his whole PLC is doing the project, they can encourage each other, "So it's easier to do projects like this [school-wide PBL], it's easier to kind of lean on one another." Whether encouragement comes from a coach, a student, or a peer, teachers at Orchard Middle School shared that this encouragement served as social persuasion helping them to continue in their implementation of PBL and helped them feel more successful, raising their self-efficacy.

Teachers at Orchard Middle School also talked about how they knew the administrators would be checking in on their PBL implementation. This feedback from administration in the form of checking in on when and how teachers were implementing PBL had a mixed impact on teachers' self-efficacy. Some teachers saw no feedback as a sign of success, as Betty did, "I'm proud to say I really, they really haven't said anything to me." Other teachers worried about what feedback they might receive. Cecile wondered:

> We're supposed to be, we're supposed to get some visit sometime this week, I think. But it's so, it feels, I'm sorry. I'm a very honest person. The visits feel as if it's, "ah, I got you. You should be doing this." That's how I feel about the visit.

Cecile went on to say that she thought feedback would be helpful, she just wasn't sure if that's what the visits were about:

> If they're coming around to give feedback, which would be better for you, you want to feel like "Oh, are we doing it or we're not doing well?" I don't know. I've never gotten a visit before. Yeah. And the feedback as to what we're doing. But I would appreciate if it was a visit like that.

Cecile's self-efficacy was vulnerable and she was unsure what kind of feedback she would get from school leadership. Leona had a more positive feeling about the administrative check-ins. She described it like this:

> We'll see them [administrators] asking the kids like, "What are you doing?" Asking probing questions, "Well, tell me about your project. How far have you gotten?" and so the kids are like, "Oh, look, I did this, I did that." So it wasn't really like a, like feedback to say, "Oh, Leona, you're not…" you know? They want to really just come and talk to the kids. Just to see, you know, what the kids are doing, do the kids understand the project?

Leona felt that by administrators checking and asking the students about the work served as positive social persuasion by giving her feedback about how her students were doing during the PBL implementation. In some cases, teachers had received positive feedback from the administrators. In these cases, the feedback definitely served as a positive influence on their self-efficacy. Lou shared, "getting good, positive feedback, and now implementing two or three in the last three years, it helps with your confidence, it makes you not feel as anxious and stressed about it." Administrative feedback can be very influential for some teachers in that it helps them understand that they are meeting expectations and are successful in their PBL implementation. When the process for administrative feedback is unclear or no feedback means good work, the influence of administrative feedback is less clear.

A third way that teachers at Orchard Middle School talked about social persuasion as being influential for how successful they felt about their PBL implementation was via official recognition of their PBL work. Lou talked about how when teachers from another school came to visit his classroom, he felt successful. "I'm about to have people from another school come down to my classroom into my room. Because it's really about success." In addition to visitors to his classroom, other teachers have also wanted to use a PBL unit Lou created, "Other teachers that wanted to use it or implement PBL." When asked how this influenced his confidence about PBL, Lou said, "it helps to get positive feedback, for sure. Because if you would have told me this two

years ago, I would have said I was a one or two [out of 10 for implementing PBL].” Official recognition was also important for Dan to see how his experiences with PBL were successful, he shared, “I was actually awarded from the STEM person for my work with the PBL, getting it going in the school.” These examples of feedback from sources outside of the school are also influential for how teachers evaluate if their efforts towards PBL implementation have been successful and to what extent they will be successful in the future.

Social persuasion was an important source of self-efficacy for the teachers at Orchard Middle School. Feedback from students, peers, and coaches helped teachers feel encouraged in their implementation of PBL. Check-ins from administration had a more mixed impact on teachers’ self-efficacy for PBL implementation. While positive feedback clearly enhanced self-efficacy, lack of direct feedback or worries about potential feedback had a mixed impact on teachers’ self-efficacy. Outside recognition for a teacher’s success with PBL served as a clear source of positive social persuasion and helped the teachers that were recognized this way to feel more efficacious in their implementation of PBL.

Challenges to efficacy for PBL implementation

There are several aspects to the culture and systems in place at Orchard Middle School that contribute to positive self- and collective efficacy. However, there are also themes that represent challenges Orchard Middle School is facing in terms of developing self- and collective efficacy for PBL implementation. There were four themes that teachers at Orchard Middle School discussed that indicate challenges that Orchard Middle School is facing. (1) Teachers at Orchard Middle School talked about the stress of implementing PBL which indicates negative affective states. (2) There was concern about PBL fidelity in implementation indicating that mastery experiences were not consistently high. (3) Teachers at Orchard Middle School shared that implementing PBL with challenging students was challenging. This also indicates that not all teachers were consistently experiencing high levels of mastery experiences. (4) Finally, Orchard Middle School had limited opportunities for PBL models, either as individual teachers or as a PBL school. The lack of peer models weakened opportunities for vicarious experiences. I will explore each of these themes and their relationship to the sources of self- and collective efficacy in the following sections.

Stress of implementing PBL

While positive affective states can increase self- and collective efficacy by indicating positive emotions with implementing PBL, negative affective states can have the opposite effect, lowering self- and collective efficacy. Some teachers at Orchard Middle School shared that they often found implementing PBL stressful or found it to be a struggle. This indicates a negative impact on the self- and collective efficacy for these teachers in terms of PBL implementation. For instance, Lou shared that implementing PBL school-wide required a great deal of work that was very difficult:

> It [PBL] can be quite a task to do because you have to make these projects that are going to encompass three different grade levels that have four different subjects, and have three different grade level standards and benchmarks. So there's a ton of planning that goes in with these project-based learning, really requirements, that we have.

He went on to specify that the stress is, "a big part of it, too. Having this anxiety about implementing and using the strategies." Cecile agreed and also shared how she found it hard to learn how to implement PBL and wished that she had more support, "If everybody was supporting, given some time in their class to support then I wouldn't feel so stressed." One specific source of stress for teachers was the conflict teachers felt between spending time on PBL and spending time on other aspects of their curriculum. Cecile discussed how teachers know they are being evaluated on aspects of their teaching that are unconnected to PBL:

> They're grading teachers. This is not back in the days when we could just teach and be free. But now they're as the people coming in to assess you, and all of that. And everybody wants a score. So nobody wants to, and the score is not on the project-based. So some people are going to put that [PBL] in the back.

Lou agreed, "it can be chaotic. Yeah, it can be stressful, and it can be hectic, and it does kind of pull you away from your traditional planning." In a blog post written by a central office employee in Orchard Middle School's district, this same concern was raised, "Teacher buy-in is an issue, along with the cornucopia of standards teachers must sort through. Time plays a big role with teachers believing PBLs must be lengthy" (rephrased from Document C3 to preserve anonymity of school). Dan agreed that the tension between implementing PBL and requirements from the state was a challenge. While he did not indicate that he felt stressed about PBL himself, he acknowledged the pressure the school was under and the resulting pushback from teachers,

“You got teachers who just don't want to do it, they just, they just don't want to do it. Our schools are under a lot of pressure to perform on testing. And they feel that the PBL projects are taking away from that time.” While not all teachers that participated in this study discussed the stress of PBL implementation, there was an indication that there was a high degree of pressure around PBL at Orchard Middle School and that this was creating negative affective states for some teachers and was likely lowering the sense of self- and collective efficacy for those teachers.

Concerns about fidelity of PBL implementation

While teachers at Orchard Middle School generally shared that their school was “a PBL school” and that they knew that there was PBL happening due to the school-wide nature of the projects and the student showcase, there was also a feeling that not all teachers were doing PBL to the same extent or in the way they could be. This evidence of non-mastery experiences school-wide lowered collective efficacy in Orchard Middle School in terms of PBL implementation. Betty noted that, “sometimes there are teachers as well, who, they don't feel comfortable with it [PBL]. And so they're, they're not as willing or able, and they don't take it as seriously as they should.” Dan agreed and expressed some frustration with the lack of effort some teachers put towards PBL, “it comes 3:45, they're gone. I see, you know, I'm outside having kids bring the flag down and the teachers' parking lot is empty. So they don't really put that effort into it [PBL].” Cecile also explained how she knew not all teachers were implementing the school-wide PBL because students would come into her class who had not completed the aspects of the project that other subject areas were responsible for, “then they [students] come back to you, there's nothing. And so you would have to spend time now, because, of course, you did that part. And then you would have expect for them to come back with the work.” This evidence that other teachers are not implementing PBL to the full extent provides non-mastery experiences in terms of collective efficacy; it tells them that not all teachers at their school are implementing PBL even though it is a “PBL school.”

The principal at Orchard Middle School expressed a lower sense of collective efficacy for PBL implementation at her school as well. While she was proud of the work they had accomplished with the school-wide PBL experiences, she wanted to see PBL become a regular part of instruction and wasn’t yet seeing that. She shared:

> What I'm looking for, and what will be a solidifying factor for it to be going well, the way I want to see it at my school, is for people to do PBLs within their content area

> without me going, “Okay, what's your PBL this week?” You know? Asking them about it. Them implementing it because they see the benefits of it. So that's my goal. That's what I'm, you know, striving for?

Sophia felt that her staff had gotten off to a good start prior to the COVID-19 pandemic and that they had made good strides since then. However, she holds herself “up to a really high standard. So while I feel like we've hit the mark, I just feel like there's so much more where we can go.” She emphasized that she’d really like to see PBL as an integrated part of instruction at the school, “implementing PBLs within your content area without even thinking about it. So that's really the goal. When you know, when you know that happens, then it's a big win for everybody.” So while Sophia felt that there were good examples of mastery experiences happening at her school with the school-wide PBL experiences, for her, the school has not yet met what she considers mastery experiences for PBL. This imbalance between her ideal PBL school and her current PBL school depressed her sense of collective efficacy for PBL implementation.

While there were many examples of mastery experiences at Orchard Middle School in terms of PBL implementation, there were also some challenges shared. Some teachers felt that not all teachers were either implementing the school-wide PBLs at all or were not doing so with the level of commitment required for the school to be successful with PBL implementation. As a result, collective efficacy for PBL implementation was lowered. Similarly, the principal wants to see PBL implementation go beyond the school-wide projects that are planned. Her hopes for teachers to begin to make PBL a regular part of instruction have not yet been achieved. Because she is striving for this higher level of PBL implementation and not yet seeing it, her sense of collective efficacy for the school is also lowered.

PBL harder with challenging students

One challenge that came up at Orchard Middle School was that teachers felt that PBL can be difficult to implement when teachers are struggling with negative student behavior. A few teachers talked about how they struggled more with PBL when they were struggling with a class. Lou specifically shared:

> So if we're trying to implement a PBL, and one group is just so behaviorally challenged, as we like to say, and you can't do anything with them, because you're just trying to figure out the management of that group. It can be hard.

When Lou found the behavior challenging, it lowered his self-efficacy for implementing PBL because he felt that implementing PBL when he was struggling with classroom management would be too difficult. Betty also talked about how students that have not had success in school require a lot of support with PBL:

> There are certain students that are very, they hear something and they turn off. They've got a low battery, okay? They turn off, you know, they, right away, they "I can't do this, I can't do this. It's beyond my ability" and so that's the most challenging.

Betty was clear that she has developed strategies to empower these students but also that it is a challenge that makes PBL a demanding task with some students. Her discussion of challenging students was mixed in terms of her self-efficacy for PBL implementation. She described strategies she's used that had some success which raised her self-efficacy but also described how difficult it can be, resulting in lower self-efficacy. Dan acknowledged that some students can make PBL harder for some teachers but also that PBL can often be exactly what the student needs:

> So if they [challenging students] can go into the classroom and be a leader, then that would solve the problem for the teachers, for those kids that I work with. Teachers have to find that common ground with that student to get them motivated enough to be that leader in a group, for example, to get the job done.

Dan went on to point out that PBL offers these opportunities with the emphasis on student voice and choice and student collaboration. So while Dan was acknowledging that some students are more challenging than others, he felt more successful with PBL because he felt those students performed better with PBL thus his self-efficacy remained high even when implementing PBL with difficult students. Historically at Orchard Middle School, PBL had only been done in gifted classrooms. This changed with the school-wide PBL initiative. In a blog post about PBL implementation at Orchard Middle School, the author discussed how thinking about PBL as only strategy for only gifted students was beginning to shift, "the idea that PBL is only for gifted students has been challenged and now PBL is for every student. The outcomes have shown that engaging, relevant learning isn't just for some learners. All students can experience success with the proper scaffolds" (rephrased from Document C3 to preserve anonymity of school). While the teachers that participated in this study seemed committed to doing PBL with all their students, PBL for all is a new concept that Orchard Middle School is still learning how to embrace and

support. Their mixed experiences implementing PBL with all students had a mixed impact on teachers' self-efficacy for PBL implementation.

Lack of PBL models

While teachers at Orchard Middle School were aware of the requirements for the school-wide PBL experiences and often collaborated on planning these with their peers, they were less aware of the specifics of how other teachers implemented either the school-wide PBL experiences or other PBL units. The ability to see other teachers implement PBL can be an important vehicle for vicarious experiences that support self-efficacy. Teachers at Orchard Middle School did not feel like they had the opportunity to observe other teachers when it came to PBL. When asked about opportunities to see other teachers implementing PBL, Cecile said, "I didn't get a chance to go see anybody and nobody comes to look at me." Leona agreed, when asked what she knew about other teachers' implementation of PBL, she explained she knew about other teacher's implementation of PBL through seeing student work, "I mean, when you talk to the kids, and you see their project, you know what is going on from, from the kids? Not necessarily going into the class and you know, watch them, you know, teach the assignment for the PBL?" Betty concurred, "Unless you ask a teacher, personally, you really wouldn't know." Lou pointed out that sometimes a project might be highlighted or he might learn about a PBL in his PLC, but in general, he didn't know much about other teachers' implementation of PBL:

> Unless it's highlighted by our administrator. All right, or unless it's highlighted, like in the morning announcements or something like that? I really don't know, especially in other content areas. Like I would know if I would probably know if someone's doing PBL within my content area. But to say that I know what's going on in math or language arts? Not not really unless it's being highlighted by the school in some way.

In a follow-up email with Cecile, she shared that she thinks being able to observe other teachers would help her, "Having this experience [seeing other teachers teach PBL] will boost confidence after seeing the process in reality." This lack of peer models for teachers results in a lack of vicarious experiences. Because vicarious experiences can support the development of self-efficacy, teachers at Orchard Middle School didn't have much opportunity to directly observe other teachers or learn from their examples, limiting the impact of this source of self-efficacy.

In addition to not being able to watch teachers within their building, Orchard Middle School had limited opportunity to observe or learn about PBL at other buildings. When

considering vicarious experiences that develop collective efficacy, schools need the opportunity to visit other schools that are implementing PBL to observe how other schools approach PBL. Without this opportunity, collective efficacy can remain low. For instance, Cecile asked about how Orchard Middle School was approaching PBL and mused, “I was wondering, are we doing it wrong?” Because she hasn’t seen PBL at other schools, she was unable to determine how successful or unsuccessful her own school’s implementation was. Sophia, the principal, also expressed how she is unclear about how her school compares to other schools:

> My wonder always is, how other schools are, what their struggles are, and what has worked, and it's always important to me to try to hear from a principal with a school that looks like mine, you know, and that has the same kind of struggles that I do.

She went on to say that prior to the COVID-19 pandemic, the district had supported efforts for principals to conduct observations at other schools. She found this very supportive and reflected on how those visits helped her, “it just felt like I left there with ideas and things that you could bring back to your school, because, you know, we shared and again, every, we each went to different schools, so, but we don't do that anymore.” As Sophia states, vicarious experiences are most impactful when the model is most similar to the observer. The chance for Sophia to observe PBL at schools similar to her would offer her more ideas about how to successfully implement PBL at a school and contribute to higher collective efficacy. The district seems to understand this and in a press release issued by the school district celebrating award winning PBL middle schools, describes how district leaders introduced “PBL Learning Walks and created time in leadership meetings for time focused on PBL collaboration" (rephrased from Document C2 to preserve anonymity of school). However, these opportunities were not reported as being available for the staff or administrators at Orchard Middle School, thus lowering the opportunity for vicarious experiences that may have increased collective efficacy for PBL implementation.

Summary of Orchard Middle School, sources of self- and collective efficacy, and PBL implementation

At Orchard Middle School, mastery experiences, social persuasion, and affective states played a very significant role in the self- and collective efficacy of teachers’ adoption of PBL into their classrooms. Teachers at Orchard Middle School saw their school as a “PBL school” and saw that student outcomes and their own improvement at PBL served as mastery experiences for their collective efficacy for PBL implementation. Furthermore, the clear, school-wide

expectations for how PBL was to be implemented at Orchard Middle School served as social persuasion for how to implement PBL as well as providing encouragement and curricular resources. School-wide routines and procedures such as PLC meetings also support mastery experiences and social persuasion for collective efficacy. PLC meetings spent with teachers sharing resources they were using in their PBL implementation and having administrators check-in during PBL to answer questions and remind teachers of the timeline of the project supported both mastery experiences and social persuasion. Positive affective states provided further sources of collective efficacy for PBL implementation in that teachers felt their administrator was approachable and supportive. In terms of self-efficacy, mastery experiences also served to enhance teacher's self-efficacy for PBL implementation. By noticing positive student outcomes and their own improvement at PBL as individual teachers, the staff at Orchard Middle School was developing their self-efficacy for PBL implementation. Teachers also derived self-efficacy from the social persuasion from student and peer feedback, administrator checks, and official recognition for their PBL implementation. Orchard Middle School also was experiencing some challenges to their self- and collective efficacy. Some teachers were experiencing negative affective states and felt that PBL implementation was difficult and stressful. Specifically, teachers also felt that implementing PBL with challenging students was challenging, lowering their self-efficacy. In a follow-up interview with a teacher leader he mentioned that for the second semester Orchard Middle School has changed the school-wide PBL to be done in research classes instead of in content classes to alleviate some of the stress expressed by teachers. Another challenge to collective efficacy was that some teachers felt that other members of the staff were not implementing PBL with fidelity. There were few opportunities at Orchard Middle School for teachers to observe each other implementing PBL or to visit other schools that were implementing PBL. This lack of vicarious experiences may also have prevented self- and collective efficacy from further developing. This is also something that the administration has tried to change since the time of the original interviews. Teachers are now encouraged to visit each other's classrooms more. While Orchard Middle School is growing in their PBL implementation and many teachers are feeling that their own PBL implementation is successful and that the school is a PBL school, there is room for more opportunities for different sources of self- and collective efficacy to be developed. The leadership at Orchard Middle School has a

great opportunity to build on the good work that is already done to continue building the self- and collective efficacy of the teachers at Orchard.

CHAPTER FIVE: DISCUSSION

The purpose of this study was to understand how the different sources of self- and collective efficacy (mastery experiences, vicarious experiences, social persuasion, and affective states) influence teachers' self- and collective efficacy for PBL implementation. Specifically, my research questions were:

- What role do the sources of self- and collective efficacy play in teachers' self- and collective efficacy for PBL implementation?
- How does the role of the sources of self- and collective efficacy for teachers' implementation of PBL differ across different contexts?

Overall, results from the three cases suggest four main findings - 1) PBL efficacy requires clearly defining success, 2) the importance of joy and trust in PBL efficacy, 3) structures and routines that support PBL foster multiple source of efficacy, and 4) opportunities for vicarious experiences of PBL implementation are rare. I discuss each of these findings in detail below.

Finding #1 - PBL Efficacy Requires Clearly Defining Success

Each school in this study had clear, school-wide expectations for successful PBL implementation that influenced teachers' self- and collective efficacy for PBL implementation via mastery experiences and social persuasion. In order for teachers to determine if their own and their peers' PBL implementation is successful and therefore providing mastery experiences, they need to know what successful PBL implementation looks like. In addition to serving as mastery experiences, these clear expectations also provide social persuasion for teachers that these expectations can and should be met. These mechanisms provide sources that support teachers' self- and collective efficacy for PBL implementation.

In Forest High School, teachers and administrators referred to high-quality elements of PBL like driving questions, sustained inquiry, student collaboration, student voice and choice, authenticity, and reflection as important factors in successful PBL implementation. Furthermore, Forest High School had specific expectations for student outcomes that were also clearly defined and communicated to teachers. These expectations included: knowledge and thinking, oral communication, collaboration, written communication, and agency. The clear student outcomes expected as a result of PBL implementation, further assisted teachers in determining if their PBL implementation was successful. Knowing key indicators of successful PBL implementation and key outcomes for students allowed teachers to know what components of PBL implementation

are effective; thus, serving as mastery experiences. It was also a clear expectation in Forest High School that PBL was the norm for instruction, that PBL should be regularly and consistently implemented. The fact that these clear expectations were communicated to teachers through PLC routines and administrative feedback provided social persuasion that PBL implementation was expected and achievable when aligned with high-quality indicators. These expectations also supported teachers being able to recognize when their own PBL implementation, as well as their peer's PBL implementation, met school-wide expectations, which provided mastery experiences.

In Park Middle School, the same high-quality elements of PBL were emphasized as those in Forest High School: driving questions, sustained inquiry, student collaboration, student voice and choice, authenticity, and reflection. The teachers in Park Middle School also used these indicators to describe their successful PBL implementation, recognizing that meeting these expectations led to mastery experiences. The principal discussed how he and his administrative team became experts in these indicators and provided training to the students and parents on these indicators. The messaging from administrators around these expectations provided social persuasion for teachers that these expectations could and should be met. The administration at Park Middle School expected teachers to implement one or two PBL "experiences" each year. PBL "experiences" were lessons that incorporated high-quality indicators but might not involve a long-term project. For instance, there might be student choice in assignments and an opportunity for revision, but the project may not necessarily have a driving question or a public-facing product. The result of the expectation that teachers implement PBL once or twice a year, and that the PBL "experience" involves some, but not all, of the high-quality indicators of PBL meant that a teacher at Park Middle School recognized PBL implementation mastery experiences through these expectations. The fact that these expectations were clearly communicated through administrative messaging to staff, parents, and students also created social persuasion for teachers, sending the message that they were capable of meeting these expectations.

Orchard Middle School had a third, different expectation for PBL implementation success. In Orchard Middle School they implemented school-wide PBL experiences in which each content area teacher was responsible for one part of the project and teachers were expected to fulfill that requirement by meeting certain benchmarks in the project. Teachers at Orchard Middle School could recognize a mastery experience when they completed their assigned part of the project or when their students completed the step of the project outlined for their subject area.

These mastery experiences were not necessarily aligned with all of the high-quality indicators of PBL. However, the prescriptive instructions for how each content area was to implement PBL was clearly defined, allowing teachers to have mastery experiences for the way PBL was implemented at Orchard Middle School. The expectations for the school-wide PBL were communicated at all-staff meetings, during PLCs, and when administrators conducted walk-through observations. These clear expectations also served as social persuasion in that teachers received messages from administrators and peers that completing their part of the PBL project was expected and that they were capable of completing that portion of the school-wide PBL.

Bandura (1997) identified mastery experiences as the most influential source of self- and collective efficacy. He posited that when an individual has completed a task successfully they feel they are more likely to be successful at this task in the future. In the context of teaching and learning, Linnenbrink and Pintrich (2003) described how students with "positive and relatively high self-efficacy will more likely be engaged in the classroom in terms of their behavior, cognition and motivation" (p. 136). Tschannen-Moran, Woolfolk-Hoy, and Hoy (1998) have expanded on this idea for teacher efficacy explaining that "the perception that a performance has been successful [mastery experience] raises efficacy beliefs, which contributes to the expectation that performance will be proficient in the future" (p. 211). As teachers have more mastery experiences, they develop higher self-efficacy, which leads them to seek out and implement engaging strategies and be more resilient when faced with barriers in teaching (Tschannen-Moran et al., 1998; Morris & Usher, 2011). In the case of teachers or schools implementing PBL, this means that a successful implementation of PBL provides mastery experiences that increase teachers' efficacy beliefs about future PBL implementation. In this study, it was clear that as teachers and schools implemented PBL and felt successful with it, it had a positive influence on their self- and collective efficacy.

It is important to specify here that part of the positive influence on self- and collective efficacy in these three schools was the fact that teachers in these three schools knew what was expected for PBL implementation and therefore could recognize when their PBL implementation was a mastery experience. This clarity of expectations for PBL implementation is important because unlike other aspects of teaching, what constitutes a mastery experience for PBL implementation can be nebulous for teachers. Specifically, PBL is often considered an ill-defined pedagogy (Condliffe et al., 2017). As Dean et al. (2023) point out in their qualitative study about

teachers' PBL goals and practices, "high quality project-based learning is extraordinarily complex, requiring the mindsets, skills, and professional judgment necessary to engage in self-directed, collaborative learning organized around a common project" (p. 8). Therefore, for teachers, having specific expectations and guidance on what successful PBL implementation looks like can lead to higher self-efficacy.

However, there is very little prior research on PBL efficacy. We can draw from few studies that have examined the role of self- and collective efficacy on other student-centered pedagogies such as reform-based mathematics and problem based learning. While these pedagogies have some differences from PBL, there are similarities in the challenges teachers face when implementing these methods that have implications for PBL research. In one study, Gabriele and Joram (2007) examined teachers as they shifted to a reform-based mathematical approach. Researchers found that teachers changed what information they used to decide if their lessons were effective; as teachers became more experienced with reform-based mathematics, they focused more on student thinking than on achieving lesson goals. This suggests that teachers' interpretation of successful implementation of lessons matters in how their teaching experiences impact their self-efficacy. The sources that a teacher may have used to judge success in a traditional teaching approach (coverage, completion, compliance) no longer applied when enacting reform based mathematics. It is also important to note that teachers themselves may not have a clear notion of what constitutes a mastery experience in a student-centered pedagogical approach. In one study, Hodges et al. (2016) described case studies of eight teachers implementing a science problem-based unit. The authors found that some teachers defined their success based on student learning and engagement, whereas other teachers based success on implementing the unit as intended from professional development.

In summary, these findings show that well-defined and clearly communicated expectations for successful PBL implementation can enhance teachers' self- and collective efficacy. Providing specific expectations for PBL success enables teachers to see whether their PBL implementation meets these standards, thus serving as a mastery experience. In order to raise efficacy for teachers and schools in terms of PBL implementation via mastery experiences, the school must provide a clear definition of PBL and clear expectations for how PBL should be implemented.

Finding #2 - The importance of joy and trust in PBL efficacy

When laying out the four sources of self- and collective efficacy, Bandura (1977) placed the least importance on physiological or affective states. However in this study, the emotions involved in implementing PBL played a prominent role in how teachers thought of their own, and their school's, efficacy for PBL implementation. In this study, teachers in Forest High School and Park Middle School often shared how much fun PBL was to implement. Teachers used phrases such as "it was a blast," or it was a "breath of fresh air," to describe their implementation of PBL. Furthermore, teachers reported how implementing PBL just "felt right." as they shared that their teaching style aligned with PBL or that they wouldn't teach any other way. This sense that PBL was enjoyable and that this pedagogical approach was aligned with their own beliefs created positive affective states - a state of joy - for teachers at Forest High and Park Middle school. Furthermore, when asked to rank the importance of their enjoyment of teaching PBL against other influences such as feedback from administrators or knowing PBL is the expectation at their school, the majority of teachers at Forest High School (three out of the five that responded to member checking) and Park Middle School (both of the two teachers that responded to member checking) placed enjoyment of implementing PBL as their number one influence. This positive association of enjoying PBL potentially serves as a significant source that fosters higher self-efficacy. Previous research by Haatainen and Aksela (2021) has found that teachers report an advantage to teaching PBL was the joy and positivity it created in the classroom. Bandura identified affective states as a source of efficacy by explaining that people make positive evaluations of their abilities when in a good mood and negative evaluations of their abilities when under stress or in a negative affective state. "Successes under positive mood spawn a high level of perceived efficacy" (Bandura, 1997, p. 112-3). The reported joy of implementing PBL in this study supports Bandura's ideas that positive emotional states provide important information to individuals in determining their self-efficacy. Previous studies also support the role of affective states in the development of teacher efficacy (Adams & Forsyth, 2006; Gabriele & Joram, 2007). For example, in Phan's (2015) study of English as a Foreign Language teachers in Vietnam, affective states played an important role in how teachers interpreted other sources of efficacy. Affective states combined with social persuasion or vicarious experiences influenced how teachers interpreted those sources of efficacy. Similarly, in a quantitative study, Burić and Moè (2020) surveyed 546 Croatian teachers about teacher

efficacy, positive affective states, and job satisfaction. In their analysis they found that positive affective states (measured as “enthusiastic”, “interested”, “determined”, “excited”, “inspired”, “alert”, “active”, “strong”, “proud”, “attentive”) were highly correlated with teacher efficacy and suggested that positive affective states work as an antecedent to teacher self-efficacy.

While Forest and Park teachers focused on enjoyment of PBL, which reflects positive affective states, teachers from Orchard primarily focused on stress related to PBL. In particular, teachers discussed how implementing PBL with challenging students was even more difficult and stressful. Orchard teachers reported that in classes where they were already struggling to manage classroom behavior, they also were struggling to implement PBL. Theyalso felt anxiety about being able to prepare students for statewide assessments that would not necessarily reflect the skills students were learning during PBL. One reason the stress of PBL implementation reported by Orchard teachers could be higher than reported at the other schools was because PBL implementation was new to them. In addition, efficacy and its sources may be reciprocal in nature: as teachers feel more efficacious, their enjoyment (and positive affective states) may increase, which then increases their self-efficacy. As Orchard Middle School implements PBL more and as more teachers create their own projects, there may be an opportunity to develop more positive affective states.

Reference to emotional states wasn’t just contained to teachers’ own PBL implementation, teachers also discussed positive emotional states of their peers as well as the positive school culture around PBL implementation. These school-wide positive affective states have a positive impact on collective efficacy for PBL implementation. The teachers at both Forest High School and Park Middle School talked about the positive culture at the school and how trust (whether among the teachers or between the teachers and the administration) contributed to collective efficacy for PBL implementation. Teachers at Forest High School specifically talked about feeling like a family. This feeling of closeness and support made it easy for teachers to share with others teachers when they needed PBL encouragement, maintaining a positive affective state even when finding challenges with PBL. The teachers at Park Middle School shared that their principal was a source of trust and support and reported how his confidence in them eased the staff’s apprehensions about PBL implementation. Paul's support and trust, empowered them to adopt PBL strategies and created a positive feeling on PBL implementation across the school.

Prior research supports this idea that the collective sense of joy that teachers feel in a school could serve as a source for teacher efficacy. For example, MacMath et al., (2017) found that teachers reported the importance of the "positive feeling" that was created knowing their whole school was engaged in PBL together. While MacMath did not specify the role this "positive feeling" had for collective efficacy, prior research has found that a strong sense of support and trust can lead to higher teacher efficacy. In one study, Lee et al., (2011) found similar results in their study involving 33 primary and secondary schools in Hong Kong, observing that trust in colleagues was either moderately or strongly correlated with teacher collective efficacy. DeCarvalho and colleagues (2023) also found that affective states were an important component of raising collective efficacy. In their case study of a five-year reform-based mathematics professional learning experience with elementary teachers, they analyzed the structures of professional learning and how these structures supported different sources of collective efficacy. They found that supporting positive affective states for the teachers was an important function of professional learning. While they argued that affective states as a source of efficacy is difficult to define, they found that "happiness, satisfaction, or enjoyment" can raise teachers' assessment of efficacy (p. 10).

The way that affective states for the whole school were described at Orchard Middle School were slightly different than how the teachers at Forest High School and Park Middle School described affective states. While teachers at Orchard Middle School specifically talked about how they knew their principal would support them as they tried new PBL strategies, there was also a sense that they needed to comply with the PBL expectations. Teachers at Orchard Middle School more frequently spoke of the difficulty to get all staff members on board with PBL and of peers that were not doing their part with the implementation of PBL. Prior research has found that negative affective states can have a negative impact on collective efficacy. In their study with twelve primary teachers in Australia, Loughland and Nguyen (2020) found that several teachers reported negative affective states associated with the professional learning which then had a negative impact on collective efficacy. Similar to teachers at Orchard Middle School, the authors found that there was a need for more trust and support building among the teachers to create more positive affective states.

Just as clear expectations about PBL are essential to developing mastery experiences, fostering positive emotional states may be especially important when considering efficacy for

PBL. Several previous studies have found that teachers find PBL challenging (Harris, 2014; Capraro et al., 2016; Wilson, 2021) as they find it difficult to shift to student-centered learning (Wilson, 2021), to monitor open-ended student products (Shaw et al., 2020), and to align PBL units with district pacing guides (Harris et al., 2015). However, in Forest High School and Park Middle School where positive affect was high, teachers rarely brought up these issues. In Orchard Middle School where affective states were mixed, teachers were more likely to describe challenges of implementing PBL (scheduling, student grouping, scaffolding PBL for a variety of learners). This suggests that positive affective states can lead teachers to persist with implementing PBL even when faced with typical challenges, while negative affective states can make these challenges seem more daunting. It may be that if PBL feels good to teachers, raising their sense of self- and collective efficacy, they are more likely to continue implementing PBL even though it is challenging.

Finding #3 - Structures and routines that support PBL foster multiple sources of efficacy

In this study, all three schools were working to either build or maintain structures and routines that support PBL, like PLCs and protocols like Critical Friends. When viewed through a social cognitive theory lens, which emphasizes the interconnected influence of behavior, cognition, and the environment (Bandura, 1977), these structures and routines were powerful as they touched on multiple sources of self- and collective efficacy; thus, fostering more confidence in teacher's own and other's PBL implementation. These structures and routines may be particularly important for PBL implementation which teachers find to be loosely defined and challenging to implement. This study demonstrates that PLCs and supportive protocols can support several sources of efficacy for PBL implementation.

In particular, PLCs and specific routines like Critical Friends Groups can impact teacher efficacy via multiple sources of efficacy. In Orchard Middle School, PLCs allowed teachers to learn about the expectations for the PBL projects and clearly understand whether their own PBL implementation was a *mastery experience* or not. These clear expectations also supported *social persuasion* as PLC members clarified expectations and encouraged each other to meet those expectations. Furthermore, PLCs provided peer support that developed positive *affective states* as teachers felt PBL was more manageable. Park Middle School teachers also shared the influential role of PLCs in how they felt about their PBL implementation. Whether they saw the PLCs as an opportunity to be a role model for others (Helen - *mastery experience*), or a chance to

collaborate with others (Sarah - *vicarious experience*), or a way to get help and support with the coordination of large scale projects (Kyra - *affective states*), these teachers also found PLCs to be sources of efficacy. At Forest High School, the use of the Critical Friends Group (CFG) along with established PLCs served multiple sources of self- and collective efficacy. CFG used a structured feedback routine in which teachers presented a project idea to other teachers, the other teachers then asked clarifying questions and offered suggestions and the CFG concluded with the presenting teacher reflecting on those suggestions and thanking their peers. This CFG protocol provided *vicarious experiences* for teachers as they learned about each other's projects and saw how other teachers were thinking through PBL implementation. In addition, CFG provided *social persuasion* as teachers saw what was expected as well as received feedback and encouragement on their projects. The CFG protocol also developed supportive and trusting positive *affective states* since teachers shared drafts of projects and opened themselves up to feedback.

The use of PLCs and routines like CFG are especially important when supporting a school in its PBL implementation. Because expectations around PBL are often vague and amorphous (Condliffe et al., 2017), PLCs and CFGs can help to solidify high-quality elements of PBL and establish school expectations of PBL. The iterative work during PLCs provides teachers with *mastery experiences* as they can identify successful PBL implementation. PLCs provide vicarious experiences as teachers get the opportunity to learn about other teachers' projects or methods of implementation. Prior research supports this finding that collaboration and support amongst teachers influences their efficacy. For example, Goddard and colleagues (2015) found schools with high levels of teacher collaboration had higher collective efficacy and theorized that the opportunity for vicarious experiences via teacher collaboration (as would be found in a PLC) contributed to the high collective efficacy. PLCs also serve as a space for s*ocial persuasion* for teachers through feedback and encouragement, which builds efficacy for implementation. Prior research has similarly found that having a supportive peer or peer group increases teachers' likelihood of continuing to implement PBL (Dunbar & Yadav, 2022). Finally, PLCs create a supportive space for teachers where they can share challenges of PBL implementation or share resources so each teacher doesn't feel isolated with the demands of implementing PBL. Previous research has suggested that teachers collaborating in a PLC feel supported as other PLC members take on elements of planning and executing the project, such as reaching out to

community partners (Viro et al., 2020). Finally, the positive *affective states* that can be fostered in supportive PLCs can further enhance the self- and collective efficacy of the teachers.

There is little prior research that discusses the role of PLCs for efficacy in PBL implementation; however, there are some studies that examine the role of PLCs for efficacy in other instructional areas. Exploring the impact of PLCs for teacher efficacy in these studies offer some possible insights about how PLCs may also support efficacy for PBL implementation. In a quantitative analysis of a survey measuring teacher collective efficacy and the effectiveness of PLCs with 310 teachers across 16 schools in one school district, Voelkel and Chrispeels (2017) found a strong correlation between high-functioning PLCs and collective teacher efficacy.
In their work with English language teachers in Vietnam, Phan and Locke (2015) found that encouraging teachers to work collaboratively can influence teacher efficacy in a number of ways. The opportunity to reflect and collaborate with peers can "reduce teachers' feelings of isolation (emotional states), strengthen their collaboration with colleagues (social persuasion) and build up their sense of teaching accomplishment (mastery experiences)" (p. 80). These findings have also been supported with quantitative studies focused on collective efficacy. Lee et al. (2011) administered teacher surveys to faculty in Hong Kong and found that PLCs with high value on collective learning and with supportive structures were positively correlated with high collective teaching efficacy for instructional strategies. In summary, structures like PLCs and CFGs support self- and collective efficacy for PBL implementation in that they offer opportunities to develop multiple sources of self- and collective efficacy.

Finding #4 - Opportunities for vicarious experiences of PBL implementation are rare

Opportunities for teachers to observe each other implementing PBL or to see models of PBL implementation varied across the three schools in this study. Being able to observe other teachers can provide vicarious experiences for teachers that can enhance their self- efficacy by demonstrating that a task like PBL implementation is achievable and possible. Vicarious experiences for collective efficacy, while defined in different ways across the literature, enhance collective efficacy by providing models for how the school, as an organization, can successfully implement PBL. Opportunities for teachers and administrators to learn about PBL implementation in other schools was also rare.

Vicarious experiences that support self-efficacy

At Forest High School, teachers referred to vicarious experiences when describing peer PBL mentors, comparing their PBL implementation with other teacher's implementation, and by seeking models via social media, databases, and conferences. While peer mentoring at Forest High School was not always systematic in nature, several teachers shared that having a peer that showed them how to implement PBL and provided concrete vicarious experiences enhanced their self-efficacy for PBL implementation. Furthermore, many teachers measured their own skill at PBL implementation in relation to the other teachers at their school, showcasing their knowledge of how other teachers implement PBL. Teachers at Forest High School also sought out models beyond teachers in their immediate circle by looking for examples of successful PBL on social media, in online databases of project ideas and resources, and at teaching conferences. Teachers at Forest High School seemed to benefit from these different opportunities to see PBL implementation modeled for them via vicarious experiences.

Teachers at Park Middle School valued the role of a peer providing a model for how to implement PBL and discussed vicarious experiences within the context of their PLC; however there seemed to be less opportunities to do so than at Forest High School. While the teachers at Park Middle School did provide some examples of learning from the modeling of other teachers, opportunities to do so beyond their PLC were more limited. Despite the lack of opportunities for peer observation, there was a belief among teachers that having a peer mentor was an effective way to gain confidence and raise self-efficacy for PBL. It is interesting that even though there were not multiple examples of how these teachers benefitted from vicarious experiences, they expressed that this was important for increasing self-efficacy for PBL implementation.

In Orchard Middle School there was limited opportunity for vicarious experiences. While teachers at Orchard Middle School were aware of the requirements for the school-wide PBL experiences and often collaborated on planning these with their peers, they were less aware of the specifics of how other teachers implemented either the school-wide PBL experiences or other PBL units. Several teachers indicated that this would be a valuable experience and would like the ability to learn from others and the principal and coach indicated that it was a goal to incorporate more peer-to-peer observation. Given this opportunity, it would be likely that those vicarious experiences could enhance self-efficacy for PBL at Orchard Middle School.

The lack of opportunities for teachers to observe their peers aligns with findings from the 2018 Organisation for Economic Co-operation and Development (OECD) Teaching and Learning International Survey (TALIS). This report indicated that fewer than half of the 137,886 teachers surveyed across 48 countries had the opportunity to participate in peer observations in the preceding year. Given the lack of opportunities for vicarious experiences for teachers, it is not surprising there is limited research on the role of vicarious learning in developing teacher efficacy. In one study that was not specific to PBL, Mather and Visone (2024) conducted a qualitative study with thirteen teachers engaged in collegial visits which are a specific format for peer observations and offer vicarious experiences. The researchers found that the participating teachers' self-efficacy was improved as a result of conducting collegial visits. While research specifically about the role of vicarious experiences and PBL is limited, some prior research indicates teachers would value the opportunity for more vicarious experiences. For example, a study by Viro et al. (2020) found that Finnish teachers identified their primary needs for enhancing their PBL implementation were access to project examples and guidance from peers with more PBL experience. This value of and desire for vicarious experiences is also reflected in a study of award-winning professors by Morris and Usher (2011). Participants in this study also listed vicarious experiences as powerful but rarely could identify a direct vicarious experience that influenced their own self-efficacy. Bandura (1977) named vicarious experiences as the second most influential source of self-efficacy yet it seems under-utilized in schools implementing PBL.

Vicarious experiences that support collective efficacy

Opportunities for school-wide vicarious experiences that could enhance collective efficacy were also few. For the three schools in this study, it was rare for schools to be aware of PBL implementation at other schools or to have had the opportunity to observe how other schools implement PBL. Forest High School had the most awareness of PBL implementation in other schools as a result of being part of a national PBL organization that hosts conferences and supports school visits. The principal at Park Middle School likewise had an opportunity to visit another school implementing PBL and while some of the teachers at Park Middle School had hosted other schools, none had visited another school to see PBL implementation. The administrator and teachers at Orchard Middle School had the least exposure to PBL at other schools. Two teachers and the administrator at Orchard wondered aloud during their interviews

about how other schools implemented PBL and asked the researcher her opinion about how their school was doing PBL. The lack of vicarious experiences that might have influenced collective efficacy for each of these schools seems to be a missed opportunity to further develop collective efficacy for PBL implementation.

Research on the role of vicarious experiences for collective efficacy is sparse (Zhou, 2019). While Goddard et al. (2004) theorized that the role of vicarious experiences for collective efficacy happens at the organization level, with schools visiting other schools, consequent research has operationalized vicarious experiences as those in which several staff members are collaborating with each other (Loughland & Nguyen, 2020; Versland & Erickson, 2017). While all three case studies had examples of teachers working collaboratively on PBL implementation, very few had experiences with observing PBL implementation at other schools. In terms of collective efficacy for PBL, and vicarious experiences as a source of that collective efficacy, there is no prior research that I was able to draw on. It seems likely that the chance for schools to observe each other could serve as a useful support for collective efficacy for PBL implementation.

Relationship of factors that relate to sources of self- and collective efficacy for PBL implementation

In these three schools, four main themes emerged that relate to the sources of self- and collective efficacy for PBL implementation: (1) PBL efficacy requires clearly defining success, (2) the importance of joy and trust in PBL efficacy, (3) structures and routines that PBL foster multiple sources of efficacy, and (4) opportunities for vicarious experiences of PBL implementation are rare. Figure 11 demonstrates how these findings connect to each other and relate to the sources of self- and collective efficacy.

Connections: Clear Definitions of PBL success

Clearly defining what PBL is and what it should look like in classrooms, along with clear expectations of how often and in what ways teachers should implement PBL, is an important factor in supporting teachers' self- and collective efficacy for PBL implementation. As can be seen in Figure 11, clear definitions of and expectations for PBL relate to several sources of self- and collective efficacy. These clear expectations and definitions provide a barometer by which teachers can determine if their PBL implementation can be considered mastery experiences (for self-efficacy) and if the school as a whole is meeting these expectations for PBL implementation

(for collective efficacy). Clear definitions and expectations provide social persuasion by conveying to teachers individually (self-efficacy) and the school as a whole that PBL is achievable (collective efficacy).

Connections: Joy, Trust, and Support

The importance of joy and trust while implementing PBL across a school had a strong influence on affective states for both self- and collective efficacy of PBL implementation. Forest High School and Park Middle School both reported high levels of individual joy related to PBL implementation and also high levels of trust among the teachers and between the teachers and the administration. While this joy and trust primarily relates only to positive affective states for self- and collective efficacy (as opposed to other factors that relate to multiple sources of self- and collective efficacy), this finding is significant because the role of positive affective states is usually under-emphasized in efficacy scholarship.

Connections: Peer critique and reflection

The use of protocols that support peer-to-peer critique and reflection relates to numerous sources of self- and collective efficacy as shown in Figure 11. By serving to provide mastery and vicarious experiences for teachers, reinforcing PBL expectations through social persuasion, and creating a trusting culture among teachers, the PLC protocols touch on many sources of self- and collective efficacy. This connection to multiple sources of self- and collective efficacy indicates the important role these structures could have in schools that implementing PBL school-wide.

Connections: Observations and visits

Finally, peer observations and school visits would relate directly to vicarious experiences for self- and collective efficacy respectively. While few instances of peer or school visits were reported in the study, teachers and administrators reported that they would find these valuable if they were made available. As the current operationalization of vicarious experiences for collective efficacy is still being crystallized, it is important to recognize the role that more school-to-school visits could have on collective efficacy for PBL implementation, especially since no other aspects of vicarious experiences for collective efficacy were reported by the participants in this study. In addition to showing the relationships between these findings and the sources of self- and collective efficacy separately, Figure 11 also demonstrates the relationship among self- and collective efficacy and among the findings. These sources do not stand in isolation from one another activating independently, rather there is a connection among factors

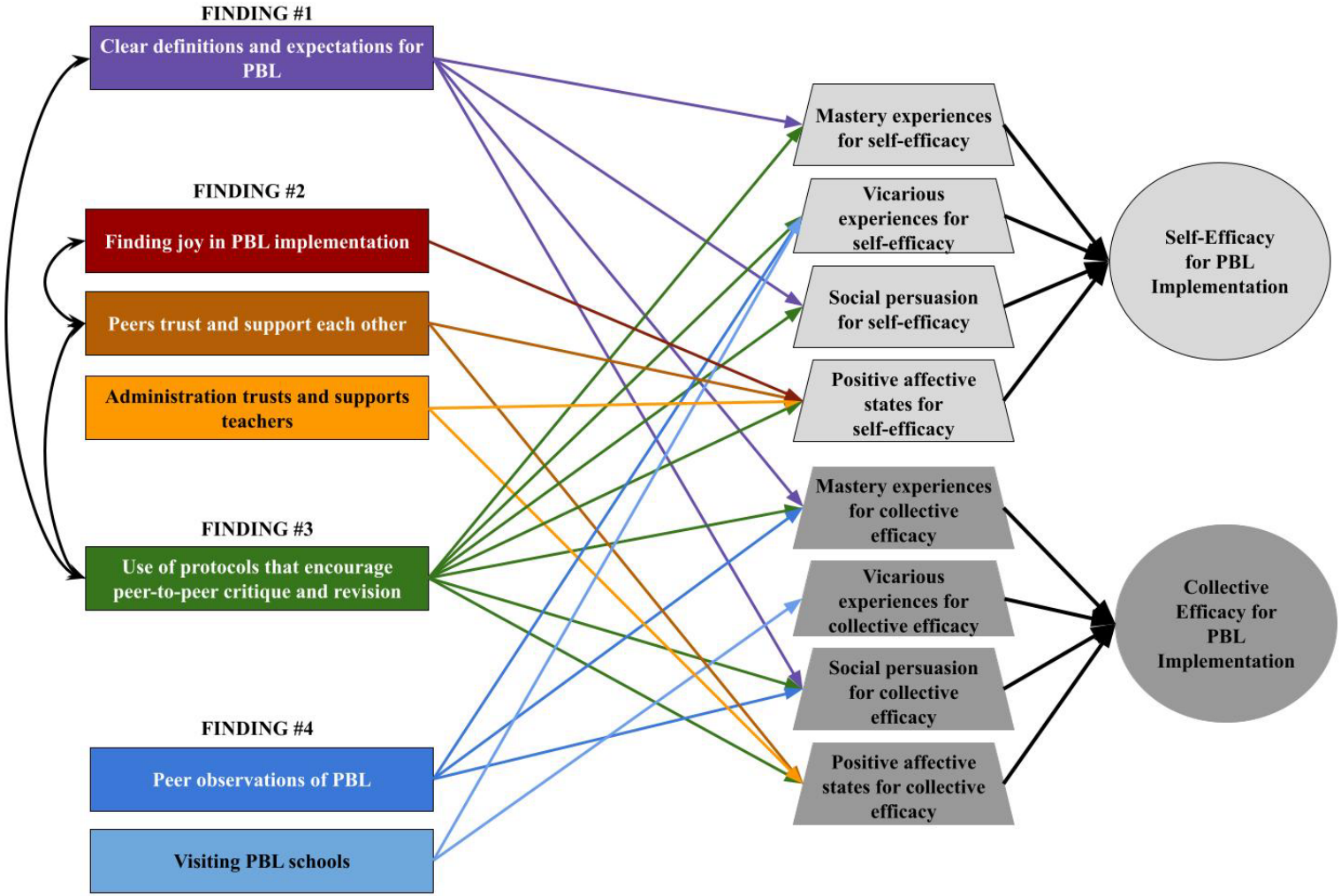


Figure 11

The relationship of factors that relate to sources of self- and collective efficacy for PBL implementation

like clear PBL expectations and both self- and collective efficacy. This interrelatedness serves to create an interconnected model for enhancing self- and collective efficacy for PBL implementation in schools.

Implications for PBL research as it relates to self- and collective efficacy

Relationship of PBL challenges and self- and collective efficacy

One area for future research involves determining how high self- and collective efficacy may mitigate the challenges typically reported with PBL. In this study, the schools where teachers had confidence in their own and their peer's PBL implementation, teachers rarely mentioned the typical context challenges reported with PBL (time, school schedules, varying levels of students' prior knowledge or academic skills, pressure from standardized testing). However, teachers at Orchard Middle School that reported less confidence in their self- and collective efficacy, all of these barriers were mentioned. Teachers at Orchard Middle School discussed challenges with the new block schedule, the way students are grouped, pressure in regards to standardized tests, and that PBL was difficult with challenging students. It may be that teachers with high self-efficacy and schools with high collective efficacy believe that they can implement PBL regardless of these contextual factors. More research that balances qualitative methods with quantitative methods could examine the relationship between teacher efficacy and their PBL implementation. A larger, quantitative study that uses a traditional measure of teacher efficacy like the the Teacher Sense of Efficacy Scale (TSES) (Tschannen-Moran & Hoy, 2001), along with measuring teachers' attitudes and beliefs towards PBL, could allow researchers to examine relationships between self- and collective efficacy and typical barriers and challenges reported in regards to PBL implementation.

The role of joy and supportive cultures in PBL implementation

In addition to understanding how high self- and collective efficacy influences PBL implementation in schools, results from this study suggest that self- and collective efficacy for PBL relies more strongly on positive affective states than prior research had indicated. In this study, the joy of teaching PBL and the personal consonance of teaching in a way that resonates with your own teaching beliefs had a significant influence on teachers' beliefs about PBL implementation. Bandura (1997) posited that "tasks that will lead to people relying more on affective states are those that involve large amounts of information and require global rather than specific information" (p. 112). PBL is a teaching strategy that meets this criteria (Condliffe et al.,

2017). Miller et al. (2021) posited that a design principle for PBL Science units should focus on teaching and learning that "accentuate the enjoyable and intellectually satisfying for sustained motivation and engagement" (p. 762). Understanding the role of joy in promoting higher efficacy for PBL implementation could offer promising insights for PBL research.

In addition to the importance of positive affective states for self-efficacy, more research about how schools and school leaders can develop supporting, trusting cultures could be promising for schools to implement school-wide PBL. While it is also difficult to determine which came first in Forest High School, the supportive, trusting culture or the PBL implementation, it was clear that there was a reciprocal relationship. As we see increased teacher burnout with more professionals leaving the field, understanding how a school can be a supportive place may offer some relief to the challenging climate many teachers find themselves in.

What kind of modeling and observations serve as vicarious experiences for PBL

Vicarious experiences are important in the development of teachers' self- and collective efficacy for PBL implementation. Many teachers in this study reported looking to a variety of sources for models of PBL implementation beyond peer observation, such as social media, project databases, school learning management systems, or conferences. Vicarious experiences for teacher self-efficacy are usually operationalized as peer models on teaching teams or during professional learning. Future research should examine the role of social media, online lessons plans, or conference presentations could serve as vicarious experiences. Future research that explores how teachers' self-efficacy for PBL is influenced by viewing projects shared via social media, databases, or conferences could help determine if these venues operate in ways similar to or different than other vicarious experiences.

In addition to better understanding different models of PBL that may be useful for individual teachers, future research should also examine the role of vicarious experiences at the school level and how observing teachers at other schools could influence self- and collective teacher efficacy. Research practice partnerships (RPP) are collaborative endeavors that involve practitioners and researchers investigating a problem of practice together (Coburn et al., 2013). An RPP that consists of more than one school or school district, along with researchers, could provide valuable opportunities to connect schools with each other, allowing them to share experiences and thus serve as a source of collective efficacy at the school level through vicarious

learning. Future research should examine the role of RPPs in investigating the role of vicarious experiences in supporting collective efficacy for PBL implementation.

Implications for social cognitive theory

Further operationalizing mastery and vicarious experiences

In terms of implications for social cognitive theory, clearer definitions and operationalization of the sources of collective efficacy are needed. In prior research, mastery experiences are often equated with student achievement as measured by standardized test scores (Goddard, 2000; Tschannen-Moran & Barr, 2004). While this may be one measure that teachers use to determine if their school is successful, it is unlikely to be the only way to define mastery experiences that support collective efficacy. Teachers in this study often reflected on student development of inter- and intrapersonal skills as evidence of successful PBL implementation at their school. More research that considers student outcomes such as communication, collaboration, and problem-solving skills as evidence of mastery experiences for collective efficacy could expand how to define mastery experiences for collective efficacy.

Operationalization of vicarious experiences for collective efficacy is also needed. If individuals gain vicarious experiences from observing peers or other models, a school would likely need to observe other schools to serve as their models. However, little prior research exists that supports this operationalization of vicarious experiences for collective efficacy (Zhou, 2019). In prior research vicarious experiences for collective efficacy have been defined as schools observing the success of other schools on the organizational level (Goddard et al., 2004) or as schools in which several staff members are collaborative in their instructional practice (Loughland & Nguyen, 2020; Versland & Erickson, 2017). Bandura's (1997) theorization about vicarious experiences indicates that it is important for schools to have knowledge of other schools in order to gain vicarious experiences. Extant research does not currently use this framing (schools observing other schools) to define vicarious experiences for collective efficacy.. Future research about collective efficacy should measure ways in which the ability of teachers and administrators to observe other schools impacts collective efficacy via vicarious experiences.

Understanding the directionality of collective efficacy and its sources

In addition to developing additional measurement tools for collective efficacy, longitudinal research studies would add important perspective to the field of collective efficacy

(Klassen et al., 2010; Hoogsteen, 2020; de Carvalho et al., 2023). While mastery experiences, vicarious experiences, social persuasion, and affective states have been positioned as sources of self- and collective efficacy, there may also be a reciprocal relationship between efficacy and these sources. For instance, in this study, while positive affective states were correlated with high self- and collective efficacy, it is not clear that the positive affective states were a cause or an effect of high self- or collective efficacy. Longitudinal research that examines changes in self- or collective efficacy over time, along with changes in positive affective states could help determine the directionality of the relationship between affective states and self- or collective efficacy. Further research that administers self- or collective efficacy measures repeatedly over several years and assesses affective states could begin to determine if these relationships are reciprocal, bi-directional, or unidirectional.

Longitudinal studies that track the level of collective efficacy over time could contribute to Bandura's (1997) original theorizing about collective efficacy in that it may reveal a cyclical nature of collective efficacy with sources also serving as outcomes. Longitudinal research could also indicate if efficacy should be thought of in developmental stages rather than as an attribute that is either high or low. Some prior research has shown that teachers' self-efficacy can dip and then rise again indicating that self-efficacy doesn't just rise over time (Morris & Usher, 2011; Swan et al., 2011). Furthermore, in this multiple case study, describing collective efficacy as either high or low did not adequately describe the state of collective efficacy. For instance, teachers at Forest High School raised several questions and issues about PBL implementation at their school which indicated low collective efficacy, even while they reported that they were a leading school for PBL in the nation which indicated high collective efficacy. Teachers at Park Middle School were confident about their PBL implementation indicating high collective efficacy even though they were newer to PBL and implementing PBL "experiences" rather than full projects. Collective efficacy at Park Middle School was high but maybe less open to self-reflection than at Forest High School. Future longitudinal research about collective efficacy could develop collective efficacy frameworks that propose stages of collective efficacy rather than limiting efficacy to being discussed only as an attribute that is high or low. These stages would allow for a more nuanced method of analyzing collective efficacy at a school.

Expand the types of studies of collective efficacy

A great deal of the research on self- and collective efficacy relies on survey item measurement tools or qualitative research based on interviews (Klassen et al., 2011; Hoogsteen, 2020). There is a great deal of quantitative studies that attempt to measure overall self-efficacy or collective efficacy. And there is a growing body of qualitative work that seeks to understand the sources of self- and collective efficacy. More mixed-methods studies that use the strengths of each of these methods could be valuable for answering research questions related to how teachers weigh the different sources of efficacy and how these sources relate to each other.

Implications for practice

This study offers several implications for practice in terms of fostering self- and collective efficacy for PBL implementation in schools. These include (1) instituting supportive structures for PBL implementation which include school-wide PBL PD, PLCs that provide opportunities for collaboration, modeling, and feedback, and opportunities for formal and informal peer observation; (2) leadership that sets high expectations, provides supportive structures, and trusts teachers; and (4) maintenance of supportive structures to ensure lasting self- and collective efficacy for PBL implementation.

Supportive structures for PBL implementation

One of the promising practices for promoting self- and collective efficacy for PBL implementation is developing supportive structures. As a part of these supportive structures, schools can implement several mechanisms outlined and discussed below (1) school-wide PBL PD, (2) PLCs that provide opportunities for collaboration, modeling, and feedback, and (3) opportunities for formal and informal observations. Each of these support multiple sources of self- and collective efficacy for PBL implementation.

School-wide PBL PD

One important way to provide cognitive mastery experiences (Palmer, 2006) for teachers that serves both self- and collective efficacy is to offer school-wide PBL PD. Cognitive mastery experiences involve knowing how to do something, as opposed to enactive mastery experiences which involve doing something (Palmer 2006). Offering PD for all staff members supports *cognitive mastery* by giving teachers more information about PBL implementation. It is important that when building self- and collective efficacy for PBL implementation that teachers are offered PD that helps them understand what PBL is and how to implement it. By offering this

PD school-wide, schools can help build not just self-efficacy (individual teachers believing they can successfully implement PBL) but also collective efficacy (belief that the school as a whole can successfully implement PBL). School-wide PD can also provide *social persuasion* that supports collective efficacy for PBL implementation in that by providing this PD school-wide, it is sending a message that PBL is what is expected of all teachers. These PD opportunities send a message that the teachers at each school are capable of implementing PBL by investing the time in professional learning. Engaging in the PD together supports *positive affective states* in that teachers have opportunities to support each other and be supportive of others. Studies focused on PBL also found that providing high quality PD and following that PD with ongoing collaborative support are enabling conditions for school-wide PBL (Zuckerbrod et al., 2021). School-wide PBL PD can also support positive affective states. When teachers feel that they are part of a larger effort to implement PBL, they feel more supported which promotes positive affective states. These positive affective states can enhance self- and collective efficacy at the school for PBL implementation. The multiple case studies presented here build on prior research indicating that PD can be helpful for PBL implementation and offer further data about what PD structures can be especially effective. By taking a social cognitive lens and considering the sources of self- and collective efficacy, schools can go beyond "offering PD" and ensure that the PD supports sources of self- and collective efficacy.

PLCs that provide opportunities for collaboration, modeling, and feedback

PLCs support multiple sources of self- and collective efficacy but do so in a way that complements and extends PD. Similar to PD, information shared in PLCs can create *cognitive mastery experiences* by providing a forum for information sharing about PBL best practices. Unlike much school-wide PD, especially that delivered by external organizations, PLCs can provide *vicarious experiences*. Routines like Critical Friends Groups that can be used in PLCs provide teachers with the opportunity to learn how other teachers are implementing PBL. When teachers share "works in progress" during a PLC, teachers can learn about how their peers are implementing PBL. Self- and collective efficacy are also strengthened via *social persuasion* in PLCs. Social persuasion also operates differently in PLCs than in PD. In PLCs, teachers get reinforcement about PBL expectations but they also get specific support and encouragement from their PLC. These more intimate conversations where teachers can ask peers for support on specific aspects of PLCs provide more individualized social persuasion than what can be offered

in a school-wide PD. PLCs can build *positive affective states* via mechanisms that differ from those provided by school-wide PD. PLCs can be a space where teachers check in on each other and support one another. This safe, trusting culture allows for more of the risk-taking required of PBL implementation. Prior research has shown that PLCs that have key characteristics (shared and supportive leadership, collective learning and application, and supportive conditions and structures) were significantly and moderately correlated with teacher collective efficacy (Lee et al., 2011). Schools should ensure that PD efforts are supported by PLCs that engage in productive practices such as built-in time for project sharing, providing feedback, and encouraging each other.

Opportunities for formal and informal observations

A third school-wide practice that is supportive of the sources of self- and collective efficacy for PBL implementation is peer observation. While peer observation is often considered a source of vicarious experiences for self-efficacy, peer observation can also serve other sources of self- and collective efficacy. For instance, when teachers have the opportunity to observe multiple other teachers implementing PBL, they can have *vicarious experiences* but these observations also serve as a source of *mastery experiences for collective efficacy* in that teachers see that many teachers at their school are implementing PBL. Furthermore, the teacher that is being observed is getting the message via *social persuasion* that they are skilled at implementing PBL and this raises their own self-efficacy. Teaching can often be an isolating profession in the sense that very little of your day is interacting with adults who perform tasks similar to yours. Creating more opportunity for peer observation can provide multiple sources for self- and collective efficacy. Schools should consider ways they can offer more peer observation of PBL implementation.

Leadership is critical to set expectations, enact supportive structures, and to build trust

Key to creating these structures (school-wide PD, PLCs, and peer observation) is the school leadership in buildings striving for school-wide PBL implementation. School leaders are the ones that set clear expectations, implement supportive structures like PLCs, school-wide PD, and peer observations, and set the tone of the school. Prior studies have established the importance of leadership in terms of fostering collective efficacy. Goddard et al. (2015) found the role of leadership to be an essential part of collective efficacy development and found that leaders in school with high collective efficacy, “set high standards for teaching and learning;

were aware of classroom practices; made systematic and frequent classroom visits; and were directly involved in helping teachers improve their instructional practices" (Goddard et al., 2015, p. 527). In addition to ensuring school-wide PD and purposeful PLCs as detailed in the prior section, school leaders should set clear, school-wide expectations for PBL and develop a culture of support and trust. Zuckerbrod et al., (2021) found that an important enabling condition for schools that want to foster school-wide PBL is creating a culture in which teachers feel "agentic, making instructional decisions and adapting PBL curriculum in their classrooms to support the needs of their students." A similar study by Miller et al. (2021) found that a "critical enabler" of the depth of PBL implementation was teachers' feeling trusted to adapt PBL for their contexts. Principals leading PBL implementation at their schools need to set high expectations for PBL implementation and trust their teachers to meet these expectations.

Maintenance is required for lasting PBL implementation

Keeping a PBL school focused on PBL takes maintenance. It is not a matter of bringing in presenters to conduct a workshop and then telling teachers they have to implement PBL. To create a "PBL school" an ecosystem must be created. PD is an important fertilizer that allows seeds to grow and enriches the soil, but tiny seeds of PBL need continued sunlight, watering, and support to help it grow. And once a PBL tree grows, the work is not done. PBL needs to be supported. While Forest High School has been implementing PBL for over 20 years and has an international reputation as a PBL school, teachers' sense of self- and collective efficacy was still somewhat fragile. They recognized that they needed to keep training their new teachers and continue to set clear expectations about what PBL looks like and how it should be implemented. Park Middle School has laid some important foundational pieces for PBL by training teachers, students, and parents about high-quality indicators of PBL and setting expectations for two PBL experiences each year. While self- and collective efficacy was currently strong at Park Middle School, it will be important for continued professional learning, supportive PLC structures and routines, and the support and trust of the principal. Orchard Middle School has made great strides in a few years to implement PBL as school-wide projects. As self- and collective efficacy develops for this approach, additional professional learning and PLC support will be needed to shift teachers to implementing PBL as part of their regular instruction, not just completing the assigned school-wide project. It is important that as schools begin their PBL journey that they

attend to the self- and collective efficacy in terms of PBL implementation and lean on structures that will support teachers via the sources of self- and collective efficacy.

Limitations

There are several limitations to the study. The main source of data for these multiple case studies was teacher and administrator interviews which present several issues. Interviews only provide self-report – what the interviewee wants to disclose. The teachers and administrators in this study may have self-edited how they truly felt about their school context and PBL. My role as a perceived "expert" may have influenced the candor with which participants were willing to express any negative aspects of PBL implementation at their school. I tried to account for this in a number of ways. I established an interview protocol where I emphasized my own positionality as a school-based employee and as a researcher with interest in PBL rather than expertise. I also used document analysis as a tool to corroborate facts that the participants shared with me and interviewed several teachers at each school in an effort to find counter-examples. While being able to observe teachers implementing PBL may have added additional data to this study, that was not a feasible approach within the context of this study.

Another limitation in this study was case selection. While I made every effort to select cases from a wide range of geographical locations and with schools at various stages of PBL implementation, it is likely that the schools and school systems that were willing to participate were schools and school systems that already felt confident in their PBL implementation. In addition, the teachers that responded to the call for interviews likely felt confident in their PBL skills. As this is an exploratory study, I believe these cases, the schools, and the teachers, still provide an important perspective on the role the sources of self- and collective efficacy have on PBL implementation.

Finally, as has been pointed out in prior research, determining the direction of causality with the established sources of efficacy and efficacy is a very thorny issue. As Hoogsteen (2020) pointed out, more longitudinal studies need to be done to determine the directionality of this work. For instance, is it that schools with a trusting, supportive culture and therefore positive affective states led to collective efficacy for PBL? Or is it that when schools feel efficacious in their PBL implementation that there is greater trust and support?

CHAPTER SIX: CONCLUSION

Project-based learning has been shown to increase student achievement, engagement, and interpersonal and intrapersonal skills (Halvorsen et al., 2012; Parker et al., 2013; Krajcik et al., 2023; Condliffe et al., 2017). However, the practice is not widely implemented (Seitsinger, 2005; Thacker et al., 2017). While some research has examined the challenges and barriers of implementing PBL (Thacker et al., 2017; Dunbar & Yadav, 2022), there are limited studies that have considered the enabling school conditions that would encourage PBL implementation (Zuckerbrod et al., 2021). Understanding the role of teacher motivation in PBL implementation and how schools can create conditions that lead to teachers feeling successful at PBL are needed if more schools and school systems wish to implement PBL. This study investigated how self- and collective teacher efficacy affects PBL implementation. It employed a social cognitive framework to examine the impact of various sources of self- and collective efficacy on teachers' PBL implementation. Furthermore, this study compared three different school contexts and explored how these sources of self- and collective efficacy played similar or different roles in different contexts.

This study adds to the field of PBL literature by deeply describing how three schools pursue implementation of PBL in ways that support (or do not support) the sources of self- and collective efficacy. Recommendations from this study include the importance of schools establishing clear definitions and expectations for PBL as doing so supports several sources of self- and collective efficacy. Similarly, this study indicates that supportive structures such as PLCs are effective in advancing PBL implementation in that they also support several sources of self- and collective efficacy. The frequency with which teachers spoke of the fun and joy of implementing PBL and how it made them feel like they were teaching in a way that aligned with their beliefs indicates that the role of affective states may be significant in terms of PBL implementation. An overlooked and under enacted support for PBL implementation may be peer observation and school-to-school observation as teachers that did have these opportunities indicated that they were very meaningful to developing their efficacy for PBL implementation.

This study also adds to the field of social cognitive theory by exploring how teachers consider different sources of efficacy when implementing PBL both in terms of their own implementation of PBL and in the implementation of PBL in their school. The interrelated nature of the four sources of self- and collective efficacy need further attention as the way teachers in

this study considered different supports for PBL often involved more than one source of efficacy. Similarly, the reciprocality of the sources of efficacy and the development of efficacy needs more attention. In this exploratory study it was clear that there was a relationship between positive affective states and efficacy for PBL implementation but it was less clear if the positive affective states were the source of the efficacy or the effect. More longitudinal studies could help to understand these relationships more thoroughly.

If schools and school systems wish to enact more PBL in their schools and classrooms to improve academic achievement, student engagement, and inter and intrapersonal skills like communication, collaboration, self-regulation, and reflection, they need to consider the role of the sources of self- and collective efficacy for PBL implementation.

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APPENDIX A: SAMPLE INTERVIEW PROTOCOL - TEACHER

Thank you so much for agreeing to meet with me. As my email stated, my research is about how teachers think about different aspects of school culture and the implementation of PBL across a school. I hope to interview a number of different teachers from your school to understand commonalities and differences in teachers' perceptions. As a reminder, I will be recording our session. HIT RECORD!!!! The purpose of this is so that I have an accurate record of what we talked about that I can refer to once the interview is over. I may also take some notes to help me stay focused on our conversation and remind myself of points I may want to go back to. Our conversations will be kept confidential and when I write up the results of this study I will use aliases. You also have the right to withdraw at any time if you don't want to continue with the study. Any questions before we get started?

Questions	Possible follow-up prompts	Rationale
Tell me about your current teaching position.	What subjects do you teach? What is the school like? What are the kids like?	Opening "soft" question
Tell me about any experiences you've had with project-based learning, if any.		Establishes teacher's relationship with PBL. Offers opportunity to learn about how the teacher defines PBL.
How did you first learn about PBL? *If no experience:* What do you know about PBL?		Determines if the teacher came to the school with PBL knowledge or acquired it at the school. Also may offer insights to social persuasion or vicarious experiences
How has PBL impacted your classroom practice? *How might PBL impact your classroom practice?*		
If you need help planning a PBL unit, what do you do? *If no experience:* If you wanted help planning a PBL unit, what would you do?		
If you need help implementing a PBL unit, what do you do?		

If no experience: If you wanted help to implement a PBL unit, what would you do?		
(If participant brought a student artifact) Tell me about the artifact you brought.	<u>Experience with PBL:</u> How does it fit into your PBL unit? What qualities of PBL do you feel it showcases? Why did you choose this artifact? If you could've shown me something else, what would you have brought? <u>Little experience with PBL:</u> What about this artifact represents how you approach teaching? From what you know about PBL, how does this artifact align with or differ from PBL? What kinds of artifacts do you think teachers that use PBL typically bring?	Determine the depth of PBL implementation - would be looking to see if PBL involves key elements or not May also indicate sources of efficacy in that what student outcomes the teacher may use to judge successful implementation
(If participant didn't bring an artifact) If you had been able to bring a student artifact, what would you have chosen?	Why would you have brought that artifact? In what way would that artifact have represented your PBL unit? Little experience with PBL: In what ways would that artifact have represented your instructional approach?	
If you had to rate yourself on a scale of 1 to 10, 1 being - not at all proficient at PBL to 10 being an award winning PBL teacher, how would you rate yourself? Why?		Offers insight to teacher's self-efficacy for PBL Teacher may indicate sources for their self-efficacy

How do you feel about your own ability to implement PBL?		
What information informed your ranking?	Student feedback? Student outcomes? Peer feedback? Administrator feedback? Parent feedback? What else might you use to determine your ability to implement PBL? If these don't come up, ask the participant what each group might say about their ability to implement PBL.	Specific possibilities for sources of self-efficacy for PBL Important to stay open first to see what else comes up before follow-up questions. Also important to end with open-ended again.
Are there formal or informal systems in place for feedback about PBL implementation?	Observations? Is it part of lesson/unit plans? Part of PLC or staff meeting agendas? To what extent do these influence your perceptions of PBL implementation?	Continued data about sources of efficacy, may transition a bit to collective here. **Opportunity to ask about other documents **
If you want to learn more about an aspect of PBL, what do you do?	Internet, colleagues, consultant, administrator, coach?	Mastery and vicarious experiences
What gives you confidence as you start a PBL unit? *If no experience:* What would give you confidence to start a PBL if you were interested?	What lowers your confidence when implementing PBL?	SE, CTE and sources
What issues do you face when implementing PBL?	How do you deal with these issues?	Can get at factors that lower efficacy or mediate efficacy
SIGNAL SHIFT We've been talking a lot about your experience about PBL and teaching. In my research, I'm also interested in how what is happening at the school level also influences PBL implementation. The next few questions will ask you to think about other teachers' at your school and their experiences.		

When you think about your school, how do you feel about the other teachers' ability to use PBL? If you had to rank the school from 1 to 10 (1=not really doing PBL, 10=award winning PBL school) how would you rank it?		CTE and sources
What information informed your ranking about other teachers' ability to use PBL?	Peer observation? PLC discussions? Informal discussions? Faculty meeting? Student feedback? Student outcomes? Parent feedback? Administrator feedback? Visits to other schools? Work with outside consultants?	Sources of collective efficacy. Will be important to hear how it may be the same or different to how they use the same information to determine their own ability
In general, what messages does the staff at your school get from school leaders about PBL?	Do you feel supported in using or not using PBL? Do you feel trusted to teach how you feel is best?	SE, CTE, social persuasion, affective states, maybe mastery experiences
What do you think has provided support for teachers to implement PBL at your school?		Mastery and vicarious experiences
What issues do teachers at your school face when implementing PBL?	How do you think your peers deal with these issues?	Draws out other concerns at the school that may impact SE and CTE
What do you think gives the teachers at your school confidence to start a PBL unit?	What lowers other teachers' confidence	This may repeat some responses from support question
Is there anything else you were hoping we'd talk about or you think is important for me to consider in this study?	Or something else you wanted to say that we didn't get to?	Leaving space for interviewees to expand on any topics they want to return to or bring up.
Is there anyone else in your	Are there other materials you	

school that you think I should interview? Either someone doing PBL really well or someone who seems a bit reluctant? I'm looking for many perspectives on PBL in the same school.	could share with me that show how PBL is implemented and supported at your school? Meeting agendas? Sample lesson/unit plans? Observation checklists? Admin communication?	
Can we also get down some demographic info?	Race/ethnicity Numbers of years teaching Age range Gender identity Number of years at this school Subject area teaching # of years teaching this subject	
Thank you so much for your time. This was really interesting and enjoyable. If you think of other ideas, please feel free to email me. I'm happy to add notes to what we talked about today. I may also contact you with what I've written to have you read it over and make sure I captured your thoughts accurately.		

APPENDIX B: SAMPLE INTERVIEW PROTOCOL – SCHOOL LEADER

Thank you so much for agreeing to meet with me. As you know, my research is about how teachers think about different aspects of school culture and the implementation of PBL across a school. As a reminder, I will be recording our session. HIT RECORD!!!!!! The purpose of this is so that I have an accurate record of what we talked about that I can refer to once the interview is over. I may also take some notes to help me stay focused on our conversation and remind myself of points I may want to go back to. Our conversations will be kept confidential and when I write up the results of this study I will use aliases. You also have the right to withdraw at any time if you don't want to continue with the study. Any questions before we get started?

Questions	Possible follow-up prompts	Rationale
Tell me about the school where you work.	What is the school like? What are the teachers like? What are the kids like?	Opening "soft" question
Tell me about your current position.	What do you see as your main roles and responsibilities?	
Tell me about your own experiences with project-based learning up to this point.	As a school leader? As a teacher? As a student?	Establishes relationship with PBL
How did you first learn about PBL? *If no experience:* What do you know about PBL?		Determines if the leader had experience with PBL before working in this school or in this position. Also may offer insights to social persuasion or vicarious experiences
How have you seen PBL **influence** a teacher's practice?		Can get at the depth of PBL knowledge and implementation
How do your teachers **learn** about PBL? *If no experience:* If you could, how would you help teachers learn about PBL?	Workshops? Coaches? Each other? Individual research?	Mastery experiences Vicarious experiences
If teachers need help **planning** a PBL unit, what do they do?	Are there curricular supports?	

If teachers need help **implementing** a PBL unit, what do they do?	Do PLCs talk about PBL?	May touch on sources of teacher efficacy like vicarious experiences or social persuasion
If you had to rate your staff on a scale of **1 to 10**, 1 being - not at all proficient at PBL to 10 being an award winning PBL staff, how would you rate your staff? Why? How do you feel about your staff's ability to use PBL?	What information do you use to decide that? Student feedback? Student outcomes? Parent feedback? Administrator feedback?	May touch on sources of teacher efficacy: mastery experiences, vicarious experiences, affective states or social persuasion
Are there **formal or informal systems in place for feedback** about PBL implementation?	Observations? Is PBL part of lesson/unit plans? Part of PLC or staff meeting agendas? To what extent do you think these influence teachers' perceptions of PBL implementation?	Continued data about sources of efficacy, may transition a bit to collective here. **Opportunity to ask about other documents **
When you think about your school, how do you think teachers feel about the other teachers' ability to use PBL?	What information do you think teachers use to decide that? Peer observation? PLC discussions? Faculty meeting? Informal discussions	CTE and sources
What do you think has provided **support** for teachers to implement PBL at your school?		Mastery and vicarious experiences
What **messages** do you try to give about PBL?	Do you teachers respond?	SE, CTE, social persuasion, affective states, maybe mastery experiences
What do you think gives teachers **confidence** as they start a PBL unit?	How do you think other teachers feel?	SE, CTE and sources

What **issues** do you think your teachers face when implementing PBL? *If no experience*: If you wanted to implement PBL, what issues would your staff face?	How do you address these?	Draws out other concerns at the school that may impact SE and CTE
Is there anything else you were hoping we'd talk about or you think is important for me to consider in this study?	Or something else you wanted to say that we didn't get to?	Leaving space for interviewees to expand on any topics they want to return to or bring up.
Is there anyone else in your school that you think I should interview? Either someone doing PBL really well or someone who seems a bit reluctant? I'm looking for many perspectives on PBL in the same school.		
Can we also get down some demographic info?	Race/ethnicity Numbers of years teaching Age range Gender identity Number of years at this school	
Thank you so much for your time. This was really interesting and enjoyable. If you think of other ideas, please feel free to email me. I'm happy to add notes to what we talked about today. I may also contact you with what I've written to have you read it over and make sure I captured your thoughts accurately.		